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The Journal

OF THE

AMERICAN DENTAL ASSOCIATION

Facial Restorations—*Bigelow*

Acrylics and Dentistry—*Harris*

Public Health Dentistry—*Pelton*

Mechanical Bridge Fixation—*Phillips*

Grenz Rays and Periodontoclasia—*Brodsky*

Impression Compounds—*Schoonover and Dickson*

Photomicrography—*Sweet, Gibson and Brownell*

Fluorides in Preventive Dentistry—*Arnold*

Anodontia: Report of Case—*Feinman*

Low Phosphorus Intake—*Burrill*

Vincent's Infection—*Schluger*

APRIL 1, 1943

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RÔLE OF FLUORIDES IN PREVENTIVE DENTISTRY

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DURING the last few years, much of the research on dental caries has been related to methods of control of this disease rather than to etiology. At the same time, there has been an increased interest in preventive dentistry from a public health standpoint, an interest which recently gained impetus from reports on the dental conditions of men called into the armed services. These reports show that some practical and efficient method of control or prevention of dental caries in large population groups is of paramount importance, not only to national health, but also to the present practice of dentistry.

At the present time, there is evidence that this disease can be controlled in individual cases either by means of proper diet or by early treatment of carious lesions. In the case of dietary control, we find two schools of thought: first, that restriction of carbohydrates to a minimum will reduce the progression of caries in susceptible individuals; second, that increasing the nutritional character of the diet predisposes to a less severe attack by the disease. In the latter case, it should be noted that, at present, the acceptable scientific evidence supporting such a hypothesis can usually be adequately explained on the basis of a reduction in carbohydrates in the diet. The second method of control, early treatment of carious lesions, cannot be considered a preventive measure from the standpoint of the disease, but rather a method designed to prevent the sequelae of the disease; namely, the loss of teeth. However valuable these methods of control may be in individual cases or small study groups, it is doubtful whether such procedures can be practically applied to group populations with any degree of success. Recent epidemiologic studies, however, have indicated the possibility of a practical and efficient method of markedly reducing the incidence of dental caries in large population groups, by

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the addition of minute amounts of fluorides to public water supplies. It is the purpose of this paper to discuss the evidence supporting such a hypothesis.

Although other authors, Black,[1] Bunting[2] and McKay,[3] had called attention to a lessened amount of dental caries in areas of endemic fluorosis, it was not until 1938 that a report of this phenomenon was made by Dean,[4] who used

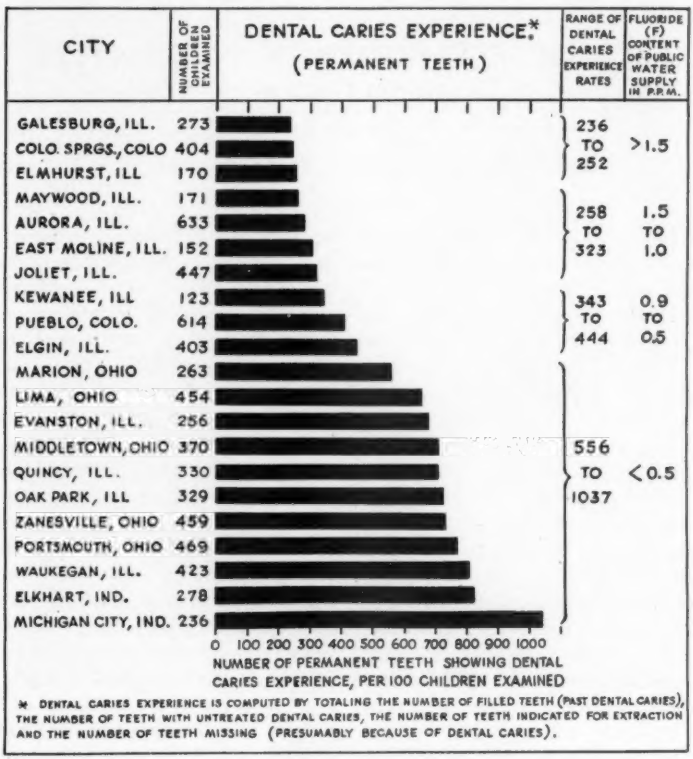
CITY
NUMBER OF CHILDREN EXAMINED
DENTAL CARIES EXPERIENCE,* (PERMANENT TEETH)
RANGE OF DENTAL CARIES EXPERIENCE RATES
FLUORIDE (F) CONTENT OF PUBLIC WATER SUPPLY IN P.P.M.
GALESBURG, ILL. 273
COLO. SPRGS., COLO 404
ELMHURST, ILL 170
MAYWOOD, ILL. 171
AURORA, ILL. 633
EAST MOLINE, ILL. 152
JOLIET, ILL. 447
KEWANEE, ILL 123
PUEBLO, COLO. 614
ELGIN, ILL. 403
MARION, OHIO 263
LIMA, OHIO 454
EVANSTON, ILL. 256
MIDDLETOWN, OHIO 370
QUINCY, ILL. 330
OAK PARK, ILL 329
ZANESVILLE, OHIO 459
PORTSMOUTH, OHIO 469
WAUKEGAN, ILL. 423
ELKHART, IND. 278
MICHIGAN CITY, IND. 236
236 TO 252
>1.5
258 TO 323
1.5 TO 1.0
343 TO 444
0.9 TO 0.5
556 TO 1037
<0.5
0 100 200 300 400 500 600 700 800 900 1000
NUMBER OF PERMANENT TEETH SHOWING DENTAL CARIES EXPERIENCE, PER 100 CHILDREN EXAMINED
* DENTAL CARIES EXPERIENCE IS COMPUTED BY TOTALING THE NUMBER OF FILLED TEETH (PAST DENTAL CARIES), THE NUMBER OF TEETH WITH UNTREATED DENTAL CARIES, THE NUMBER OF TEETH INDICATED FOR EXTRACTION AND THE NUMBER OF TEETH MISSING (PRESUMABLY BECAUSE OF DENTAL CARIES).

Figure 1.

the recently developed procedures for adequate quantitative evaluation. This evidence was supported by the results of a study in central Illinois,[5] where it was found that children born and reared in a community (Galesburg) where the water supply contained 1.8 parts per million of fluoride had a dental caries experience rate (the number of teeth per hundred children which show one of the following signs of caries experience: fillings, untreated lesions and extraction, and teeth which are indicated for extraction) about one-third as high as did comparable children from a community (Quincy) where the water supply was practically fluoride free. Additional epidemiologic studies of this type have been made and reported in the past three years.[6, 7, 8] Data from some of these reports will be reviewed in this paper for purposes of discussion, but the reader should consult the original articles for complete details.

One of these epidemiologic studies on fluorides and dental caries is that reported by Dean, Jay, Arnold and Elvove concerning the dental-caries picture in school children from eight suburban Chicago communities.[7] These cities are all in the same general locality, yet they have different types of water supplies, which have been in use for a period greater than the life of the children examined. The report deals only with children 12-14 years of age who have lived in their respective communities and have used the common water supply for all domestic purposes throughout their lives (thirty days' absence in any one calendar year excluded). Uniform methods of selecting and examining the children were used in all communities and all examinations were made by the same two dental officers. A summary of the clinical findings in these children, together with information concerning the fluoride content and total hardness of the domestic water supplies, is shown in Table 1.

TABLE 1.—SUMMARY OF DENTAL CARIES FINDINGS IN 2,832 SELECTED WHITE CHILDREN, AGED 12-14 YEARS, IN EIGHT SUBURBAN CHICAGO COMMUNITIES IN RELATION TO FLUORIDE (F) CONTENT OF PUBLIC WATER SUPPLY*

	Elmhurst	Maywood	Aurora	Joliet	Elgin	Evanston	Oak Park	Waukegan
Number of Children Examined	170	171	633	447	403	256	329	423
Water Supply Source	Deep Wells					Lake Michigan		
Total hardness in parts per million.	323.4	75.0	328.5	349.3	102.6	131.0	132.2	134.4
Mean fluoride (F) content, 1939-1940, in parts per million	1.8	1.2†	1.2	1.3	0.5	0.0	0.0	0.0
Clinical examination								
Dental caries experience, permanent teeth, per hundred children examined	252	258	281	323	444	673	722	810
Dental caries experience, proximal surfaces, upper incisors, per hundred surfaces	0.60	0.59	0.78	1.3	4.1	10.7	9.0	17.7
First permanent molar mortality, per hundred children examined	11.8	11.7	14.5	19.5	20.3	42.6	31.0	79.9
Percentage of children with no dental caries experience	25.3	29.8	23.5	18.3	11.4	3.9	4.3	3.1
Percentage incidence of endemic dental fluorosis (mottled enamel)	40.0	33.3	15.0	25.3	4.2	1.6	0.6	0.2

*Public Health Report, 56:788, April 11, 1941.

†There is both presumptive and direct evidence that prior to a few years ago, the Maywood water contained probably 1.4-1.6 parts per million of fluoride (F).

It can readily be seen from this table that there is considerable difference in the dental caries experience rates of children who were born and reared in these various communities. As was pointed out in the original report, when one considers the relative homogeneity of these urban populations and the uni-

formity of the methods followed, it is difficult, from an epidemiologic standpoint, to ascribe the observed differences to any source other than the common water supply. One of the outstanding differences in these water supplies is the fluoride content, and the results indicate that an inverse ratio exists between the dental caries experience rates and this fluoride content. The inverse correlation is further illustrated by the results of a later study,[8] which included children from thirteen other communities in the same and three other states. A graph showing this relationship is presented in Figure 1.

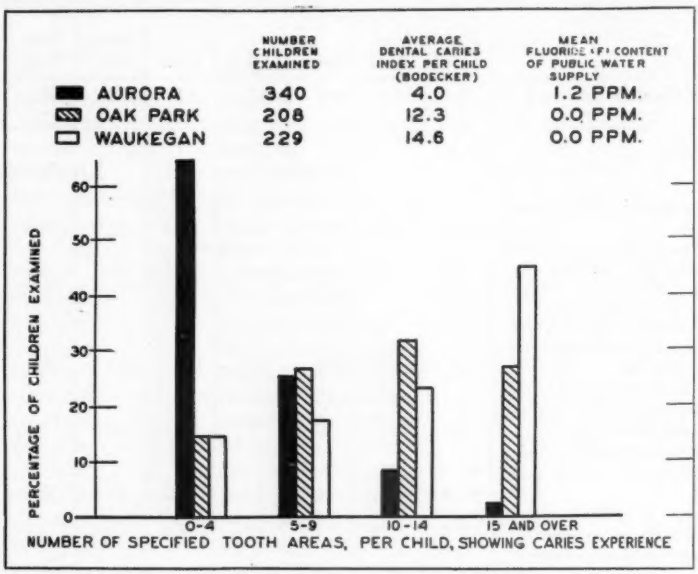

Figure 2.

Although the dental caries experience rates as shown indicate a considerable difference in the number of teeth affected by caries, they do not necessarily show the extent to which these teeth have been destroyed. This is especially true in studies of this type where a considerable difference in the intensity of dental caries attack exists between the groups examined. For example, a tooth that shows the least evidence of any carious lesion has the same weight in a caries experience rate as a tooth that has been completely destroyed by the disease. Neither do rates based only on the number of teeth affected allow for a true comparison between what may be accomplished by an extensive treatment program and what apparently is accomplished by the use of fluoride water throughout life. In view of this fact, a caries index was calculated on a representative sample of children from three of these communities. (The sample of children represents those of whom both clinical and bacteriologic examinations were made. The three communities selected for comparison were chosen on the following basis: 1. Aurora represents a community where the children have been using a water the fluoride [F] content of which is about 1.2 parts per million and the dental caries experience rate is low. 2. Oak Park represents a com-

munity where the children have been using a fluoride-free water supply, but where the economic level of the community is very high and there has been an extensive amount of treatment [fillings]. 3. Waukegan, where the children have been using a fluoride free water and have a relatively high caries rate, is representative of the average of other cities using Lake Michigan waters, but the percentage of treatment [fillings] is somewhat similar to that of Aurora and much less than that of Oak Park.) The method used for determining the caries index of each child was that described by Bodecker in 1939.[9] (Attention is called to the fact that Bodecker's caries index is calculated on a basis which tends to take into account not only the number of teeth affected, but also the size of the

TABLE 2.—DIFFERENCES IN DEGREE OF CARIES AS MEASURED BY THE BODECKER CARIES INDEX OBSERVED IN PERMANENT TEETH OF SELECTED 12-14 YEAR OLD WHITE SCHOOL CHILDREN AT AURORA, OAK PARK AND WAUKEGAN, ILL.

Individual Caries Index Figure	Aurora (1.2 ppm.*F.)		Oak Park (0.0 ppm.*F.)		Waukegan (0.0 ppm.*F.)	
	Number of Children	Percentage of Total Examined	Number of Children	Percentage of Total Examined	Number of Children	Percentage of Total Examined
0	85	25.0	6	2.9	6	2.6
1	37	10.9	2	1.0	5	2.2
2	39	11.5	5	2.4	7	3.1
3	26	7.6	9	4.3	5	2.2
4	31	9.1	8	3.8	10	4.4
5	20	5.9	9	4.3	6	2.6
6	23	6.8	10	4.8	4	1.8
7	18	5.3	14	6.7	8	3.5
8	18	5.3	14	6.7	11	4.8
9	8	2.3	9	4.3	11	4.8
10	9	2.6	16	7.7	12	5.2
11	7	2.1	13	6.3	9	3.9
12	7	2.1	12	5.8	12	5.2
13	3	0.9	14	6.7	9	3.9
14	2	0.6	11	5.3	11	4.8
15	1	0.3	7	3.4	10	4.4
16	0	0.0	3	1.4	11	4.8
17	1	0.3	5	2.4	9	3.9
18	2	0.6	3	1.4	10	4.4
19	1	0.3	7	3.4	6	2.6
20 and over	2	0.6	31	15.0	57	24.9
Total	340		208		229	
Average caries index for each child examined	4.0		12.3		14.6	
Average number extra areas affected per tooth showing caries experience†	0.4		0.7		0.8	

*Parts per million.

†Average increase in caries index figure (1) over basic figure required to place a tooth among those showing caries experience.

lesions on these teeth.) The results are shown in Table 2 and Figure 2.

It has been more or less generally accepted that whenever dental caries has been inhibited or prevented, there is an accompanying change in the oral flora as measured by *L. acidophilus* counts on the saliva. In order to determine whether this phenomenon was operative in these endemic fluorosis areas, acidophilus counts were made on the saliva of some of the children examined clinically. Some of the results of such a bacteriologic examination in one of these studies[7] are shown graphically in Figure 3.

PERCENTAGE DISTRIBUTION OF LACTOBACILLI IN THE SALIVA OF 1,761 CHILDREN EXAMINED IN EIGHT SUBURBAN CHICAGO COMMUNITIES GROUPED ACCORDING TO THE FLUORIDE (F) CONTENT OF THE PUBLIC WATER SUPPLY AND CLASSIFIED ACCORDING TO THE ESTIMATED NUMBER OF LACTOBACILLI PER CC. OF SALIVA

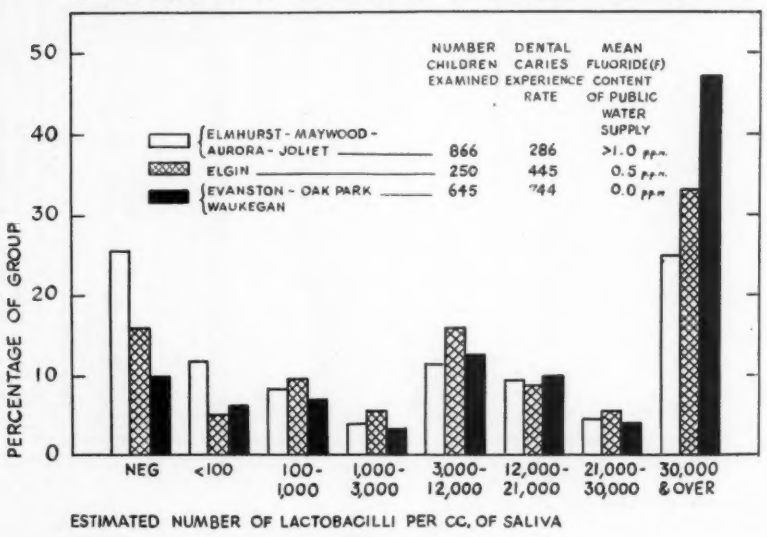

Figure 3.

The results as shown in Figure 3 indicate that there is a higher percentage of *L. acidophilus* counts of 30,000 and over and a lower percentage of negative counts in children using fluoride free waters than in children living in communities where the water contains 0.5 parts per million or more of fluoride. It has been assumed by some[10] that these differences in acidophilus counts may be only a measure of the difference in the number of open carious lesions. This assumption is not tenable when one compares the results of the bacteriologic examination of children from three of these communities where the number of open carious lesions (untreated carious teeth and extraction indicated) is similar. A comparison of these results is shown in Table 3.

DISCUSSION

The evidence as obtained from various epidemiologic studies on dental caries, some of which is included in this report, justifies the conclusion that dental caries attack is markedly less in children who have used throughout life a domestic water the fluoride content of which is about 1 part per million of fluoride. The evidence so far suggests that the fluoride

ion is the active agent. In this connection, it is necessary to consider the possibility that some factor or factors other than fluorine present in these waters may be responsible for this phenomenon. One of the factors that have been suggested by some as playing an important rôle in these differences in communal dental caries rates is the total hardness of the water. If this were true, a correlation between total hardness of the water and dental caries rates should be indicated by the results of one of these studies,[8] but no such correlation was found. Also, there is the possibility that some element other than fluorine present in the other elements commonly found in public water supplies (total dissolved solids are 46.4 parts per million). (Attention may be called to the fact that many so-called distilled waters contain almost as much in total dissolved solids. Also, the present edition of the U. S. Pharmacopeia allows 5 parts per million and the tenth edition allowed 10 parts per million total dissolved solids in the standard for distilled water.) 3. The report of Armstrong and Brekhus[11] showing that carious teeth contain less fluorine than normal teeth. Supporting this evidence in regard to human beings are the results of numerous independent experiments

TABLE 3.—TENDENCY OF NEGATIVE AND HIGH (30,000 AND OVER) L. ACIDOPHILUS COUNTS TO REFLECT INTENSITY OF DENTAL CARIES ATTACK, AS MEASURED BY DENTAL CARIES EXPERIENCE RATES, RATHER THAN NUMBER OF TEETH WITH UNTREATED CARIOUS LESIONS

City	Number of Children Examined Clinically and Bacteriologically	Dental Caries Experience, Permanent Teeth				Percentage Distribution of Salivary L. Acidophilus in Group	
		Filled Teeth (a)	Teeth, Untreated Dental Caries and Teeth Indicated for Extraction (b)	Teeth Missing (c)	Complete Caries Experience (a+b+c)	Negative	30,000 and Over
		Number per Hundred Children Examined				Per Cent	Per Cent
Joliet	233	114	205	18	337	26.2	26.6
Elgin	250	212	217	16	445	16.0	33.2
Oak Park	208	486	210	29	725	11.5	43.8

these fluoride waters is the active agent. Although it is conceded that such a possibility exists, there are certain facts already known that limit this possibility. Some of these facts are as follows: 1. The number of cities studied, which now totals twenty-one and includes 7,257 examinations, showing a consistent negative correlation between the fluoride content of various types of water supplies and the dental caries experience rates. 2. The low dental caries experience rate observed at Colorado Springs, Colo., where the water, containing 2.6 parts per million of fluoride, is comparatively free of on inhibiting induced dental caries in rats by fluorides. Thus, the evidence of both epidemiologic and experimental studies has strongly suggested the possibility of adding very small amounts of fluorides to fluoride-free public water supplies for the purpose of preventing dental caries in large population groups. Such a proposal deserves serious consideration in the light of our present knowledge.

Before fluorine can be added to any water supply, the amount to be added and the effects of addition of this amount must be considered. In regard to dental

caries, the results of studies as shown in Table 1 and Figure 1 indicate that as little as 1 part per million of fluoride would be sufficient to markedly inhibit the disease. (It should be noted that the concentration of fluorides in water supplies necessary to affect a dental caries attack may vary to some extent, depending on factors in intake, such as climate, culinary habits and possibly the fluorine content of different foods. It cannot be too strongly stressed that the fluorine-dental caries theory rests basically upon the question of the amount of fluoride ingested by the population. For example, a water containing 0.5-0.7 parts per million of fluoride in southwestern United States may have an effect equal to that of a water of 1.0-1.5 parts per million of fluoride in the north central section of this country. For this reason, it may be desirable to base precise estimates upon the more acceptable biologic measurement of fluoride intake in a population, the index of dental fluorosis.[12]) For purposes of illustration, the results obtained at Aurora, Ill., will give some idea of what beneficial change may be expected from the addition of this amount (1 part per million) of fluorine to a fluoride-free public water supply. (Attention is called to the fact that the results shown for Aurora are on children who were born and reared there. Thus, we could not expect any similar effect on another city from fluorides except in those children born after the water change.) A comparison of the dental-caries picture in Aurora children with that of children living in the three communities using the fluoride-free waters from Lake Michigan (Evanston, Oak Park and Waukegan, Ill.) will show:

1. About six times as many children showing no dental caries experience (caries free).

2. About a 60 per cent lower dental caries experience rate.

3. About a 70 per cent reduction in Bodecker's caries index. (This figure is based on the results at Aurora, Oak Park and Waukegan, Ill., as shown in Table 2, and does not include Evanston, Ill.)

4. Almost a 75 per cent decrease in first permanent molar loss.

5. Approximately 95 per cent less caries on the proximal surfaces of the four upper incisors.

A very important factor to be considered in dealing with fluoride waters is the possibility of toxic effects. Since the developing tooth is apparently the most sensitive of human organs by which toxic effects of fluorides early in life may be measured, it may be well to consider first the problem of endemic dental fluorosis. It is unfortunate that many individuals consider the toxic action of fluorine only from a qualitative standpoint, unmindful of the quantitative aspects of the problem as pointed out by Dean.[12] This is especially true in regard to the relationship of fluorides to dental fluorosis. It is obvious that if the amount of fluorine necessary to alter the incidence of dental caries would also produce the brown stain or pitting of teeth characteristic of moderate and severe fluorosis, the fluoride-dental caries relationship would be of academic interest only. Fortunately, this is not the case. To illustrate the slight amount of fluorosis discernible on the teeth of children who have used throughout life a water containing about 1 part per million of fluoride, the results obtained at Aurora, Ill., may again serve. The incidence of dental fluorosis in the 633 children examined was 15 per cent (Table 1). Such a figure, however, does not show the complete picture, as a positive diagnosis is made when an individual has as few as two teeth which show the least sign of fluorosis. Reference to the original report[7] will show that only 845, or 5.1 per cent, out of a total of 16,448 permanent teeth were diagnosed as positive, and only 57, or 0.3 per cent, were incisor teeth. In no instance was a diagnosis of "moderate" (brown stain) or "severe"

(pitting) fluorosis made. In view of these results, it may be concluded that the slight amount and very mild degree of dental fluorosis that would result from the use of waters the fluoride concentration of which is about 1 part per million can no longer be considered objectionable.

The cumulative toxic effects on the body from ingestion of fluorides in this concentration is admitted to be a possibility. However, all things considered, such a possibility seems rather remote. In this regard, it is important to emphasize the fact that, in some areas in the United States, people have been using for as long as forty years waters whose fluoride (F) concentration is 6 to 8 times that of Aurora water, and no pathologic effects, other than on the teeth, have been reported. This absence of any reported pathologic effects is not necessarily due to the fact that these areas represent isolated instances, since large communities, such as Colorado Springs, Colo., and Amarillo, Texas, have used waters of high fluoride concentration for many years.

Recently, a report on an unstated number of persons appeared in the literature[13] and the results were interpreted to indicate that there is an unusually early loss of permanent teeth in areas of endemic dental fluorosis. Others have also commented, without the support of controlled scientific evidence, that teeth in endemic areas that become carious are lost early in life because caries progresses rapidly and it is difficult to make proper restorations. These views do not seem valid when one considers that the reports of Deatherage,[14] McGibbony[15] and Pasqualini and Celli[16] indicate that selectees from endemic areas have lost fewer teeth than selectees from areas where dental fluorosis is not endemic. (These results are also supported by the findings reported by Wilson concerning dental caries in rural housewives in Oxfordshire.[7]) Also, the results as shown in Table 2 of this report indicated that, according to the Bodecker caries index, each tooth that was declared carious in Aurora had an average of only 0.4 extra areas affected as compared to 0.7 extra areas per tooth at Oak Park in spite of the high percentage of filled teeth in the latter city. Unpublished data from the Division of Infectious Diseases, National Institute of Health concerning a small group of adults, from 21 to 45 years of age, living in a community where the water supplies contain about 5 parts per million of fluoride, indicate a molar mortality rate lower than has been found for 12 to 14 year old school children using fluoride-free waters throughout life. Therefore, the results of controlled studies of this phenomenon indicate that there is not an early loss of permanent teeth in endemic areas of dental fluorosis. That it may be difficult to make a proper restoration of teeth showing "severe" fluorosis does not enter into the problem in dealing with fluoride concentrations of about 1 part per million of fluoride, as such teeth are not encountered.

In view of the evidence presented, it seems probable that preventive dentistry is on the threshold of a new era in the control of the most prevalent of all diseases, dental caries. The results of both epidemiologic, chemical and experimental studies suggest that the addition of small amounts of fluoride, not to exceed 1 part per million, to fluoride-free public water supplies may be a practical and efficient method of markedly inhibiting dental caries in large group populations.

SUMMARY

1. There is evidence permitting the conclusion that dental caries is markedly less in children who have used throughout life a domestic water the fluoride content of which is no higher than about 1 part per million.

2. The addition of small amounts of fluorides (about 1 part per million) to fluoride-free public water supplies for

the purpose of partially controlling dental caries is strongly suggested on the basis of epidemiologic and experimental evidence.

3. It has been determined that:

A. Only a small amount of fluorine is necessary to assure the desired effects.

B. A change in the dental caries experience would be expected to occur in the children born and reared in a community after such a water treatment was inaugurated.

C. The mildest type of dental fluorosis that may occur is sporadic and inconsequential and there is an unlikelihood of any other toxic manifestations.

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FACIAL RESTORATIONS

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ALL facial injuries and deformities cannot be corrected by plastic surgery, since this specialty of medicine, although it has made great advancement, is limited, as all things are, in what it can accomplish. In treating certain injuries, or after the excision or other treatment of some tumors, it is not desirable to institute additional surgical procedures. At the same time, the patient may be so deformed that he cannot take his place in society; and, since all of us are vain and self-conscious to a degree, he would not associate with people nor would he succeed very well in earning a living if he were deformed by the loss of an ear, the nose or a large portion of the face.

Fortunately, prosthetic appliances can be constructed for many of these people which will enable them to go through life without being the subject of curiosity or pity.

The gratitude of these patients to the dentist or physician who restores their appearance to normal is inexpressible, and the personal gratification from the successful completion of such a task is sufficient payment for the undertaking.

Most dentists do not realize that their training in carving and experience in handling plastics fit them admirably for the problems involved in facial prosthetics. All dentists are sculptors, especially those who are in the practice of general or restorative dentistry. Even the oral surgeon will find, as I did, that his training and manual dexterity are valuable assets in this work.

There are several requirements for a successful facial prosthetic appliance:

1. It must restore the lost part inconspicuously.

2. It must not distort, so that it will always fit static cases.

3. It must be self-retaining, making the use of adhesive powders and cements unnecessary.

4. It must be practical in order that the patient may be able to wear it daily, and not just on special occasions.

5. It must be adaptable to changes in shape and coloring, so that as the complexion changes with the time of year, it too can be changed, and, in addition, any minor changes in the tissue can be compensated without remaking of the entire appliance.

To begin, we must have an accurate method of taking an impression of the area of lost tissue. All types of materials have been used for this purpose, and I should like to stress the importance of including as much of the face and head as possible. If it is impossible, as in the loss of an ear, to include the entire face and the other ear, a separate impression of the remaining ear should be taken for a model from which to carve. Plaster adheres too tightly to traumatized and tender tissues to be used as an impression material and tears or pain will result on its removal. Also, it cannot be removed from undercuts, and if it is in too great a bulk, its weight will cause displacement.

Hydrocolloid does not irritate the softest tissues and gives an accurate impression. It will reproduce all undercuts and in most cases can be removed *in toto*. However, if the undercut is great, that part will separate so easily that the ten-

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derest tissues will be unhurt, and it can be reattached to the main body with common pins.

Hydrocolloid, in large thin impressions, will become distorted and so it must be strengthened. I have tried various devices and have adopted a simple and satisfactory technic. The hydrocolloid is warmed and then allowed to cool until it is thoroughly comfortable to the skin. It is then painted over the entire surface of the wound, and as much of the face as indicated. The patient can be permitted to breathe through his nose or his mouth, according to the section to be replaced. The material is built up in successive thin layers until about one-quarter inch thick. All undercuts are filled entirely with the hydrocolloid and it is allowed to set. When it has cooled, a light layer of thinly mixed plaster is painted over the hydrocolloid. The plaster is allowed to harden, and then another layer is painted over it, sufficiently thick to form a strong backing. In this way, an accurate impression can be secured without distortion or irritation of the tissue.

The impression is then boxed and poured in stone, with careful vibration to avoid air bubbles, and when the stone is set, the model is separated. We should now have an accurate reproduction of the patient's face, the ear or other areas.

The models are studied and the appliance is designed, giving full value to any natural undercuts and irregularities. When parts of the nose or face are missing, the appliance can frequently be stabilized by spectacles. In many instances, the patient already uses glasses, which can be incorporated in the design.

When we have decided upon the procedure, all defects are filled with baseplate wax or modeling clay and carefully carved to simulate the missing tissues. Here our ability in carving will be valuable, though, sometimes, our patience will be sorely taxed. However,

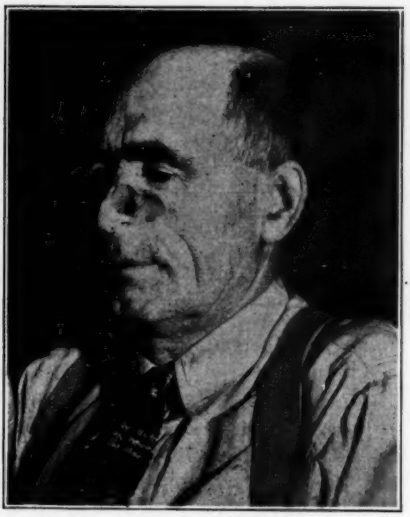

Fig. 1 (Case 1).—Cured carcinoma of nose with marked disfigurement caused by perforation of lateral wall.

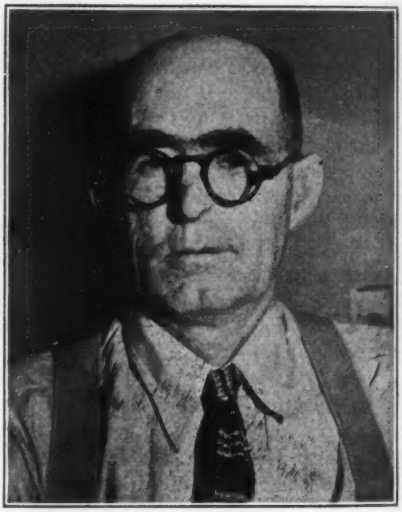

Fig. 2 (Case 1.)—Normal appearance restored by prosthesis.

one may be astonished to see how well he can do, and if he is careful, and compares his work with the natural structures, he will succeed in exactly reproducing the lost parts. If necessary, an eye can be added later.

When this procedure has been completed satisfactorily, the portion to be restored is cut from the model and inserted in a flask.

Here, we must decide on a medium. I have tried most materials used for this work, and have found acrylic resin to be the most satisfactory. Latex is not stable in shape, and, in order to keep the edges from curling away from the tissue, it must be glued down with adhesives. It is also irritating to the tissue if worn over long periods. With all appliances, the edges must be depressed or must "over" fit, so that movements of the tissues will not cause spaces between the appliance and the tissue. It is also difficult to color latex perfectly, and since it cannot be painted to alter the color, I use acrylics, which are stable and non-irritating and can be colored very nicely. The edges can be corrected to fit the tissue closely by being warmed and gently depressed. Acrylics can be repaired and can be painted.

The acrylic material is colored to match the lost tissues, and polished very little. In fact, it is usually roughened. In some cases, as in the case of a nose, the colors as mixed may be correct, but frequently it is necessary to retouch the appliance. Translucent photographic paints are excellent for this purpose, since they come in skin tones and so do not have a dead appearance. The face has many colors in it, and it is not a simple thing to duplicate them.

The appliances can be powdered with face powder if desired. The colors also change with the time of year, since some people tan and others burn. If the patient is cooperative, he will work for hours painting the appliance or may even go to art school to help himself. All of my patients would devote any amount

Fig. 3 (Case 2).—Active lupus vulgaris with complete loss of external portion of nose. The entire area is a mass of exudating ulcers.

Fig. 4 (Case 2).—Artificial nose covering the lesion and making it possible for this man to regain his place in society.

of work to keeping the appliance in harmony with the rest of the face.

There are just a few suggestions that I can offer at this point. If it is possible to use them, glasses, as mentioned before, will be of great value. When it is necessary to replace an eye, a glass imitation can be secured and be seated in the appliance with cement. It will usually be necessary to cut away part of the imitation with stones, though the distributors say it is impossible. We must just proceed slowly. Frequently, an eyebrow or hair is necessary, and it can be taken from the hair of the patient and fastened with celluloid cement.

Fig. 5 (Case 3).—Carcinoma, successfully treated with radon.

REPORT OF CASES*

CASE 1.—In a case of carcinoma of the eye, face and nose, with a cure, no surgical procedure could correct the deformity. How well the missing parts were replaced is shown in Figure 1. The patient wears the appliance continuously, and while it replaces the missing tissues, it also prevents air from coming through the face instead of the nose. (Fig. 2.)

CASE 2.—In a case of a carcinoma of the nose which was cured, the patient wears the appliance continuously and works as a logger. (Figs. 3 and 4.)

CASE 3.—A case of carcinoma which was successfully treated with radon. The patient, however, lost a large portion of his face as well as his eye and nose. (Fig 5.) Figure 6 shows restoration.

Fig. 6 (Case 3).—Prosthesis in place.

CONCLUSION

Facial prosthesis is a field open to all dentists. It is especially valuable in extensive replacements made necessary by tumors and traumatic injuries. It is of great interest at this time, since we are at war.

*The cases reported were treated by the writer at the Veterans Administration, Portland, Oregon.

THE EFFECT OF LOW PHOSPHORUS INTAKE ON THE GROWTH OF THE JAWS IN DOGS

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THIS study of the growth of the jaws is based on measurements of the heads of eleven dogs, five of which had been raised on a diet adequate in phosphorus and six of which had received a diet deficient in phosphorus. Two of the five dogs on the diet adequate in phosphorus were given vitamin D. These are later called Group I. Three on this diet that had no vitamin D are called Group II. Of those on the phosphorus-deficient diet, two had vitamin D and four did not. These are, respectively, Groups III and IV. The dogs were placed on the control and the phosphorus-deficient diets at the age of 12 weeks and were continued in the experiment until they were 26 weeks old. The diet experiment, carried out by Smith Freeman, of the Northwestern University Medical School, has been reported under the title "Experimental Rickets, Blood and Tissue Changes in Puppies Receiving a Diet Very Low in Phosphorus, with and Without Vitamin D."[1] The heads of the dogs were made available by Dr. Freeman.

In all of the phosphorus-deficient cases, the dogs developed severe rickets. One of the control dogs in Group II developed a mild case of rickets, though the only evidence of this was in the histologic material prepared at the end of the experiment. It is of interest that this dog, designated as B10, showed a mild form of the deformity that appeared in the dogs on the phosphorus-deficient diet. This deformity consisted of a disproportion in the size of the jaws, so that the mandible protruded relatively too far forward, and a further disturbance of such nature that the upper and lower anterior teeth were apart and could not be brought together, though the posterior teeth were in close contact. Figure 1 shows the x-ray photograph of one of the control dogs; Figure 2, that of one of the dogs on a phosphorus-deficient diet. In the latter, the deformity is clear.

The animals on the phosphorus-deficient diet did not grow so well as those on the control diet. Their retardation of general growth is important because it indicates that the differences in size of particular regions of the head were probably caused by an undergrowth of some parts, rather than by an overgrowth of others. The average daily gain for the dogs on the phosphorus-deficient diet was less than one-half that of those on the control diet for the period of the experiment, and, at the end of the experiment, the average weight of the control dogs was nearly twice that of the dogs on the phosphorus-deficient diet.

After the diet experiment, the heads were removed and fixed in formalin and then frozen and sawed in two along the midsagittal plane. X-ray photographs were made of the halves separately, with the same technic for all. Tracings were made from the films thus produced and the measurements that are to be considered were taken from the tracings, which were checked with the films to insure their accuracy. Tracings were super-

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imposed to ascertain whether changes in the angles of the teeth or curvature of the mandible could account for the observed differences. This was not the case.

As an additional control, measurements were made directly on the skull of a presumably normal adult dog. These figures appear in the following tables under the designation N, while the figures for the other dogs appear under the designations A5, A6 and the like.

To find the explanation for the observed defects in the jaws of dogs on phosphorus-deficient diets, a system of points was set up so that measurements could be taken between pairs of points. The points used were selected because they were visible and reasonably definite in all of the x-ray films and tracings, and because lines between selected pairs of points spanned the regions to be measured. There was no attempt to use the points that are the basis of cephalometric work on human beings, because such points could not be seen in the films. Those that were used are indicated in Figure 3.

Measurements between pairs of points were made separately on the tracings from each half of each head. The measurements were recorded separately and the average of each pair of measurements was used in the computation of ratios. The measurements were made and ratios between measurements were computed as the tracings chanced to be picked up and not in any order or by groups. The results were arranged only after all measurements were made and all ratios computed.

The ratios were designed to express the relationships between different parts of each head, and to express each relationship in a single figure so that like relationships for different heads could be compared. In this way, differences in the sizes of the heads became unimportant and only the proportions were considered. For example, in each tracing, the measurement from point P to point D, expressed as PD, represents the length of the alveolar portion of the maxilla in an anteroposterior direction. The measurement HD represents this length plus the length of the temporal region along the same line. Then the ratio HD/PD represents the relationship between the two measurements, and between the sizes of the two regions of the heads. In the head designated D18, the measurement HD is 133 mm. and the measurement PD is 82.5 mm. HD/PD is then 133/82.5. The quotient or result of this indicated division is 1.61, which is the value given for this relationship in head D18.

The same relationship was computed in the same manner for each head and the quotients were arranged in descend-

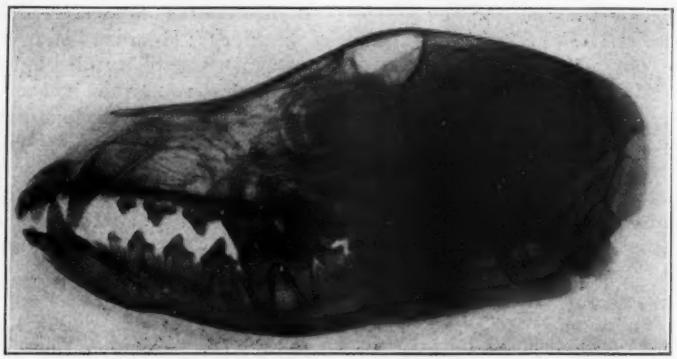

Fig. 1.—Head of dog on control diet.

ing order, starting with the highest value and progressing to the lowest. The result of this arrangement is shown in Table 1. The figures for the dogs on phosphorus-deficient diets are in italics.

In this series of ratios, the difference between the measurement HD and the measurement PD is the length of the temporal region of the head, from H to P. The meaning of this series of values is therefore that the relationship of the temporal region to the length of the maxilla is different in all of the control heads from that in all of the heads of the

TABLE 1.—RELATIONSHIP OF LENGTH OF TEMPORAL REGION TO LENGTH OF MAXILLARY ALVEOLAR REGION*

$$HD/PD = \frac{\text{Length of Maxillary-Alveolar Region Plus Length of Temporal Region}}{\text{Length of Maxillary-Alveolar Region}}$$

Dog	Value	Group
D18	1.61	I
A7	1.58	II
A5	1.54	I
N	1.52	
C13	1.51	II
B10	1.51	II
A4	*1.50*	IV
A9	*1.50*	IV
A6	*1.49*	IV
A3	*1.46*	III
C12	*1.46*	IV
B11	*1.43*	III

Probability (P) = less than 0.01

*Figures for dogs on phosphorus deficient diet are in italics in all tables.

dogs on the phosphorus-deficient diet. In all of the phosphorus-deficient cases, either the temporal region is relatively smaller than the same region in the control dogs or the maxillary-alveolar region is larger. Since the dogs on phosphorus-deficient diets were all underdeveloped, it is more likely that the first explanation is correct: the growth of the temporal region was more severely disturbed by the phosphorus deficiency than was the growth of the maxillary-alveolar region.

The statistical significance of this series, computed by standard methods, is great. The probability P expresses the chance that the particular arrangement of values would occur by accident. In this case, the probability is stated to be less than 0.01, meaning that there is less than one chance in 100 that the result is accidental. Values for P up to 0.025 are stated to be highly significant. As the values for P approach 1.0, the significance decreases. These probability values are stated for each of the tables that follow. It will be noted in some that the actual significance may be greater than the value of P indicates because this value does not take into account the particular

TABLE 2.—RELATIONSHIP OF LENGTH OF MAXILLA TO LENGTH OF MAXILLARY-ALVEOLAR REGION

$$BD/PD = \frac{\text{Length of Maxilla}}{\text{Length of Maxillary-Alveolar Region}}$$

Dog	Value	Group
A3	*0.855*	III
N	0.850	
D18	0.833	I
A5	0.825	I
B10	0.815	II
A7	0.810	II
C13	0.795	II
A4	*0.794*	IV
A6	*0.788*	IV
A9	*0.768*	IV
C12	*0.745*	IV
B11	*0.743*	III

Probability (P) = about 0.018

groupings of ratios in these cases.

When the length of the maxilla proper, measured from the orbit to the anterior tip of bone labially from the upper anterior teeth, is compared with the length of the alveolar portion of the maxilla, the relationship may be expressed as BD/PD. When these values are arranged as in the previous case, the result is as shown in Table 2.

The displacement for the value of A3 may arise from the fact that the point B was uncertain in the films of dog A3. The variation does not affect the value of

the series. Assuming that undergrowth, rather than overgrowth, is the explanation, this series indicates that growth of the maxilla proper was more severely upset than was the growth of the alveolar portion of the maxilla. This agrees with the gross observations. The maxillae were relatively small and there was an anterior open bite in all of the phosphorus-deficient group. The relative shortness of the maxilla forward from the orbit may possibly account for the open bite.

Two other series of ratios based on the cranium and maxilla may be interpreted as indicating tendencies, though the significance is not high. (Table 3.)

In the relationship FB/HP (length of cranium/length of temporal region), the ratios from the dogs on phosphorus-deficient diets, Groups III and IV, tend toward the top of the series. Group III dogs, on a diet deficient in phosphorus, but having adequate vitamin D, seemed to be the most severely affected of all of the animals. It is interesting to note that the ratios in these cases fall at the top of the series. The series may be interpreted as indicating a tendency in the phosphorus-deficient group for the temporal region of the head to be relatively more deficient in growth than the cranium proper in the same animals.

The arrangement found in the series FB/PD (length of cranium/length of maxillary alveolar region) may show that, in the deficient animals, the cranium in turn tends to be relatively smaller than the alveolar portion of the maxilla.

The same methods were applied to other parts of the maxilla and cranium, but no other significant differences were found. There may have been differences too fine to be detected by this method, but, for the present, it can be said only that the effect of the diet was greatest in the temporal region, less great in the maxilla, still less in the cranium and least in the alveolar portion of the maxilla.

For measurements of the mandible, the point H was considered equivalent to the location of the mandibular joint. The joint itself was invisible in many of the x-ray films, and the point H, clearly visible in all, was necessarily close to the joint.

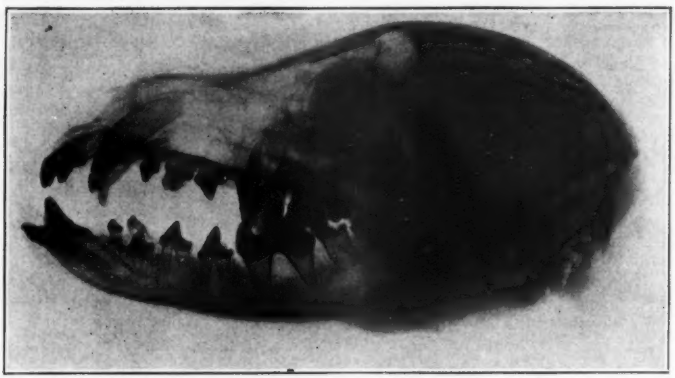

Fig. 2.—Head of dog on phosphorus deficient diet.

When the different measurements of the mandible are considered, three highly significant series of ratios are obtained. (Table 4.)

From these tables, it may be seen that growth of the posterior part of the mandible was the most severely disturbed by the deficient diet. In the relationship between the alveolar portion of the mandible (ME) and the length of the mandible back to the mandibular notch

(OE), the ratios for the phosphorus-deficient animals head the series. For these animals, the values of OE are relatively smaller than the corresponding values in the control animals. Since OE differs from ME only by the amount to which OE extends back of the point M, the difference is probably in the length posterior to M; that is, back of the alveolar portion of the mandible. The same thing appears in HE/ME, in which HE differs from ME only by the distance between M and H, or between the alveolar portion and the joint. In the dogs on a least disturbed of all the measurements.

The series of ratios giving the relationship between the total length of the mandible, HE, and the length back to the notch, OE, showed no significant differences. This may mean that the region between the notch O and the posterior end of the alveolar ridge at M was the defective region in the phosphorus-deficient cases, since the distance from O to M is included in both OE and HE.

The relative immunity of the height of the mandible to the adverse effects of the phosphorus-deficient diet appears

TABLE 3.—RELATIONSHIP OF LENGTH OF CRANIUM TO LENGTHS OF TEMPORAL AND MAXILLARY-ALVEOLAR REGIONS

FB/HP = Length of Cranium / Length of Temporal Region			FB/PD = Length of Cranium / Length of Maxillary-Alveolar Region		
Dog	Value	Group	Dog	Value	Group
B11	*2.687*	III	N	1.246	
A3	*2.456*	III	D18	1.237	I
C12	*2.438*	IV	C13	1.229	II
C13	2.383	II	A9	*1.184*	IV
A9	*2.341*	IV	A4	*1.176*	IV
N	2.340		B10	1.168	II
A4	*2.319*	IV	A7	1.149	II
B10	2.312	II	A5	1.148	I
A6	*2.300*	IV	B11	*1.142*	III
A5	2.142	I	C12	*1.130*	IV
A7	2.142	II	A6	*1.121*	IV
D18	2.060	I	A3	*1.120*	III
Probability (P) = about 0.25			Probability (P) = about 0.25		

deficient diet, since the alveolar portion is relatively longer than the posterior part of the mandible, it may be said that the posterior portion of the mandible is relatively underdeveloped.

In the series ME/TU, the mandibular alveolar length is compared with the height of the mandible from the base of the bone to the tip of the longest cusp of the first molar. It is found that the alveolar region is relatively short in the dogs on a deficient diet and that the height of the mandible is relatively unchanged. It will appear in later series that the height of the mandible was the when the figures for the height are related to the values for other parts. Comparisons of the height of the mandible with the length of the maxilla proper, with the length of the alveolar portion of the maxilla and with the length of the cranium all show the height of the mandible to be the least affected by the deficient diet. In each series of ratios, the significance was high, with values for P of either 0.01 or 0.018. These series follow. (Table 5.)

Sets of ratios were prepared to compare the lengths of corresponding parts of the maxilla and the mandible. These

show that, except for the posterior part, the growth of the mandible was less disturbed by the phosphorus-deficient diet than was that of the maxilla. In the relationship HD/HE (length of maxillary alveolar region plus temporal region/length of entire mandible), the indication is fairly clear that the maxillary dimensions are relatively less in the phosphorus-deficient group than are the mandibular. In the series PD/ME (length of maxillary alveolar region/length of mandibular alveolar region), the same is true for dogs in Group IV (diet deficient in phosphorus and vitamin D), though the significance for the whole series is not great. All figures for Group IV fall together at the lower end of the scale, while the figures for Group III are near the normal end. In both series, control head B10 falls with the phosphorus-deficient group. B10 was supposedly normal, but, as stated, gross examination disclosed the type of malocclusion that was present in the deficient group, and it was later found that B10 had suffered from rickets. (Table 6.)

The series HP/HM (length of temporal region/length of posterior mandibular region) relates the posterior portions of the lines HD and HE above mentioned. HP/HM shows no significant difference between control and deficient groups. This may indicate that the two posterior portions of the lines mentioned were affected in the same way and that the differences found between HD and HE lie in the alveolar portions of the jaws. This is consistent with the thought that the temporal and posterior mandibular regions were those most severely affected by the deficient diet.

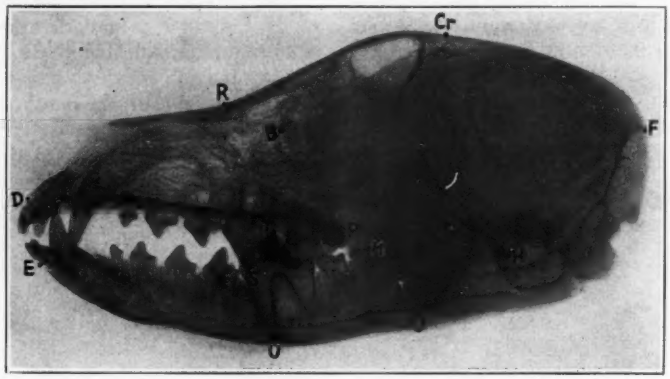

Fig. 3.—Points used in making measurements.

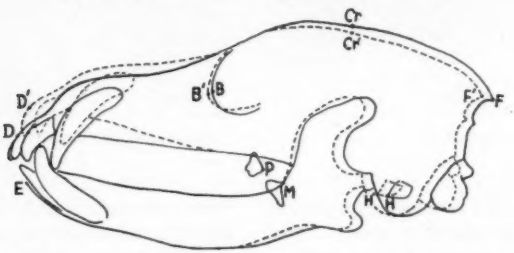

Fig. 4.—Graphic summary of differences between control and phosphorus-deficient groups in proportions of parts measured.

By other series of ratios each of which had a probability value P of 0.01 or 0.018, it was found that the alveolar region of the mandible was less disturbed in both length and height than any other region. Another series indicated, though

DISCUSSION

As the several series of ratios indicate, the animals that were kept on a phosphorus-deficient diet probably suffered greater retardation of the growth of the maxilla, the temporal region, the posterior parts of the mandible and, to some extent, the maxillary alveolar region than of the other regions measured. This does not necessarily mean that such defects of growth are specifically produced by a low

TABLE 4.—RELATIONSHIPS OF MEASUREMENTS OF DIFFERENT PARTS OF MANDIBLE

$$ME/OE = \frac{\text{Length of Mandibular-Alveolar Region}}{\text{Length of Mandible Back to Mandibular Notch}}$$

Dog	Value	Group
A9	*0.924*	IV
C12	*0.897*	IV
A4	*0.897*	IV
A6	*0 895*	IV
C13	0.886	II
A3	*0.884*	III
A5	0.878	I
B11	*0.863*	III
B10	0.859	II
A7	0.843	II
N	0.834	
D18	0.824	I

Probability (P) = about 0.018

$$HE/ME = \frac{\text{Length of Entire Mandible}}{\text{Length of Mandibular-Alveolar Region}}$$

Dog	Value	Group
D18	1.523	I
A7	1.482	II
A5	1.425	I
B10	1.412	II
C13	1.412	II
A6	*1.388*	IV
A3	*1.383*	III
A9	*1.382*	IV
A4	*1.370*	IV
C12	*1.368*	IV
B11	*1.361*	III

Probability (P) = less than 0.01

$$ME/TU = \frac{\text{Length of Mandibular-Alveolar Region}}{\text{Height of Mandible}}$$

Dog	Value	Group
B10	3.027	II
D18	3.018	I
A7	3.000	II
A5	2.990	I
C12	*2.900*	IV
N	2.858	
C13	2.819	II
B11	*2.766*	III
A6	*2.740*	IV
A4	*2.720*	IV
A9	*2.666*	IV
A3	2.630	III

Probability (P) = about 0.018

without great significance, that the posterior portion of the mandible was relatively smaller in the dogs on a phosphorus-deficient diet than was the cranium. (Table 7.)

phosphorus diet. T. Wingate Todd[2, 3, 4] described much the same type of injury to sheep from early thyroidectomy. It would be expected that any sufficiently severe general disturbance might interfere with any growth occurring at the time of the disturbance. The observed deficiencies of growth in the dogs on phosphorus-deficient diets may mean that the underdeveloped parts are those normally undergoing rapid growth at the age when the dogs were affected. Comparison of the present results with the results in cases of low-calcium diets, long-continued low-vitamin diets and quantitatively inadequate diets will be necessary before the specific effects of any particular deficiency can be defined.

TABLE 5.—RELATIONSHIPS INDICATING RELATIVE IMMUNITY OF HEIGHT OF MANDIBLE TO ADVERSE EFFECT OF DIET ON GROWTH

$$BD/TU = \frac{\text{Length of Maxilla}}{\text{Mandibular Height}}$$

Dog	Value	Group
D18	2.455	I
A7	2.385	II
A5	2.370	I
N	2.340	
B10	2.298	II
A3	*2.200*	III
C13	2.145	II
C12	*2.035*	IV
B11	*2.000*	III
A4	*2.000*	IV
A6	*1.966*	IV
A9	*1.850*	IV

Probability (P) = about 0.018

$$PD/TU = \frac{\text{Length of Maxillary-Alveolar Region}}{\text{Mandibular Height}}$$

Dog	Value	Group
A7	2.946	II
D18	2.945	I
A5	2.871	I
B10	2.821	II
N	2.750	
C12	*2.706*	IV
C13	2.700	II
B11	*2.691*	III
A3	*2.570*	III
A4	*2.519*	IV
A6	*2.515*	IV
A9	*2.410*	IV

Probability (P) = about 0.018

$$FB/TU = \frac{\text{Length of Cranium}}{\text{Mandibular Height}}$$

Dog	Value	Group
D18	3.641	I
N	3.425	
A7	3.385	II
C13	3.309	II
A5	3.298	I
B10	3.298	II
B11	*3.065*	III
C12	*3.060*	IV
A4	*2.961*	IV
A3	*2.880*	III
A9	*2.848*	IV
A6	*2.821*	IV

Probability (P) = less than 0.01

It appeared possible that some of the apparent differences between length of mandible and length of maxilla in the dogs' heads might be due to a downward tipping of the lower anterior teeth, carrying forward the labial tip of bone at the

end of which point E is located. However, when tracings of the mandibles of control animals are superimposed on tracings from the dogs on phosphorus-deficient diets in such a way that the lower borders of the mandibular tracings coincide, the points E coincide within very close limits. In no case did the bony spicule carrying the point E tip forward. Tipping could not therefore account for the differences.

In evaluating the present results, it is

TABLE 6.—RELATIONSHIPS BETWEEN MEASUREMENTS OF MANDIBLE AND MEASUREMENTS OF MAXILLARY AND TEMPORAL REGIONS

$$HD/HE = \frac{\text{Length of Maxillary-Alveolar Region plus Length of Temporal Region}}{\text{Length of Entire Mandible}}$$

Dog	Value	Group
A5	1.04	I
D18	1.03	I
A7	1.03	II
C13	1.03	II
A3	*1.03*	III
B11	*1.02*	III
A4	*1.01*	IV
B10	1.00	II
C12	*0.99*	IV
A6	*0.99*	IV
A9	*0.98*	IV

Probability (P) = about 0.035

$$PD/ME = \frac{\text{Length of Maxillary-Alveolar Region}}{\text{Length of Mandibular-Alveolar Region}}$$

Dog	Value	Group
D18	0.98	I
A7	0.98	II
A3	*0.98*	III
B11	*0.97*	III
N	0.96	
A5	0.96	I
C13	0.96	II
B10	0.93	II
A4	*0.93*	IV
C12	*0.93*	IV
A6	*0.92*	IV
A9	*0.90*	IV

Probability (P) = about 0.25

$$HP/HM = \frac{\text{Length of Temporal Region}}{\text{Length of Posterior Mandibular Region}}$$

Dog	Value	Group
C13	1.196	II
A4	*1.190*	IV
A5	1.170	I
C12	*1.163*	IV
B10	1.150	II
A6	*1.142*	IV
A9	*1.140*	IV
A7	1.131	II
D18	1.125	I
B11	*1.122*	III
A3	*1.115*	III

Probability (P) = 0.40

coincide, the points E may be made to coincide by moving one tracing forward or back, without changing its angle. Likewise, when points E are superimposed, the anterior curves and lower borders of the mandible may be made to coincide When the lower border and anterior

kept in mind that genetic differences can produce structural differences even greater than those found in these dogs. Johnson[5] has reported an experiment in cross-breeding in which extreme differences were produced.

The dogs in the present experiment

were mongrels of unknown antecedents, but they were all of the same general type. It must be assumed that any genetic differences were matters of chance. Such being the case, and since the probability values of the present results practically exclude chance as an important factor, it becomes unlikely that genetic differences account for the observed results. This is especially true when sets of ratios with probability values of one in a hundred occur repeatedly and in a systematic relationship. Then the chance that the results were accidental is almost infinitesimal.

How far the present results are applicable to human affairs is not clear. They are consistent with and may partly explain some of the observations that are reported in the literature. Shelling and Anderson[6] found more malocclusion among children who had had rickets than among those who had not, and noted much more frequent occurrence of open bite among the rickets cases than among the others. Anderson and Hurme[7] like-

TABLE 7.—OTHER RELATIONSHIPS OF MEASUREMENTS

FB/HM = Length of Cranium / Length of Posterior Mandibular Region

Dog	Value	Group
B11	*3.020*	III
C13	2.851	II
C12	*2.838*	IV
A4	*2.760*	IV
A3	*2.740*	III
A9	*2.671*	IV
B10	2.659	II
A6	*2.630*	IV
A5	2.560	I
A7	2.425	II
D18	2.319	I

Probability (P) = 0.035

FB/ME = Length of Cranium / Length of Mandibular-Alveolar Region

Dog	Value	Group
D18	1.208	I
N	1.2000	
C13	1.177	II
A7	1.129	II
B11	*1.110*	III
A5	1.101	I
A3	*1.095*	III
B10	1.089	II
A4	*1.089*	IV
A9	*1.069*	IV
C12	*1.055*	IV
A6	*1.029*	IV

Probability (P) = about 0.018

RS/TU = Maxillary Height / Mandibular Height

Dog	Value	Group
N	1.607	II
A7	1.596	II
C13	1.581	II
D18	1.561	I
B10	1.518	II
A5	1.454	I
C12	*1.442*	IV
A3	*1.380*	III
B11	*1.366*	III
A6	*1.362*	IV
A9	*1.333*	IV
A4	*1.296*	IV

Probability (P) = less than 0.01

ME/RS = Length of Mandibular-Alveolar Region / Maxillary Height

Dog	Value	Group
A4	*2.100*	IV
A5	2.058	I
B11	*2.023*	III
C12	*2.013*	IV
A6	*2.012*	IV
A9	*2.000*	IV
B10	1.950	II
D18	1.930	I
A3	*1.907*	III
A7	1.880	II
C13	1.781	II
N	1.778	

Probability (P) = 0.018

wise considered open-bite cases to be chargeable to rickets, and Meyer Eggnatz[8] found more Class I, Class III and open-bite malocclusion among the rachitic children. On the other hand, Sheldon Friel[9] and J. V. Greenebaum *et al.*,[10] after careful studies, concluded that malocclusion was not traceable to rickets.

It is quite possible that open-bite cases in children may arise in the same way as they apparently did in these dogs—partly at least from a failure of growth in the maxilla so that the upper anterior teeth do not grow down to meet the lower anterior teeth. A similar defect may account for some cases of Class III malocclusion and for those cases in which the upper anterior teeth occlude lingually from the lower anterior teeth though the molars are in proper relationship.

SUMMARY AND CONCLUSIONS

The results of this x-ray study of dogs on phosphorus-deficient diets can be summarized and the conclusions indicated by the line drawing, Figure 4. The basic outline is that of the head of one of the control dogs, which appears to have been normal and representative of the control group. Superimposed on this outline is a dotted outline indicating where and by how much the average measurements of the dogs on phosphorus-deficient diets were less than those of the controls.

It can be concluded that in these dogs the phosphorus deficiency had the following results:

1. The anteroposterior growth of the temporal region of the head and of the posterior portions of the mandible was severely retarded.

2. The growth of the maxilla proper in both height and length was greatly retarded.

3. The growth in length of the maxillary alveolar region and of the cranium proper was measurably, but less severely retarded.

4. The growth of the body and alveolar portions of the mandible was but little disturbed in either length or height.

5. The observed gross deformities, anterior open bite and mandibular protrusion can be explained on the basis of these defects in growth.

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THE ETIOLOGY AND TREATMENT OF VINCENT'S INFECTION

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THERE exists, in dental literature, a great body of writing on Vincent's infection. A great deal of this falls into a pattern so nearly constant as to be almost repetitious. Nothing could be more desirable than first to examine and then actually to put to the most rigid test of all—the clinical test—all the principles enunciated and to find them true. Unfortunately, this has not always been the case. Certain taboos and procedures have become standardized both in technic and in the literature. These must have seemed logical when they were first enunciated, and they have been perpetuated merely through habitude. Their validity has never been confirmed. So nearly universal and unquestioned have some of these procedures become that any disposition to question them evokes indignation. It is the purpose of this paper to examine some of these principles and to present results achieved by violating the most sacred tenet of the "accepted" treatment of Vincent's infection.

ETIOLOGIC FACTORS

The actual bacterial agents involved in Vincent's infection are well known. They are principally the fusiform bacillus and Vincent's spirillum. While it is generally assumed that these organisms are merely a segment of the picture of a mixed infection present in the majority of cases, most sources agree that these two organisms, or their toxins, produce the symptoms we recognize as Vincent's infection.

It is just as widely understood that these organisms can, by careful scraping, be recovered in mixed culture from nearly every normal adult gingiva.[1] This factor reduces the importance of infection in our conception of the disease. Presence of the bacteria becomes a constant, and we must search elsewhere for causative factors in their growth that make possible the syndrome of Vincent's infection.

Tissue tone enters at this point as the variable factor, promoting or inhibiting the disease.[2] By studying the causes of the raising and the lowering of tissue tone, we may discover the true etiology of Vincent's infection. Even epidemic Vincent's infection does not seem to be an exception to this rule. It seems more than a mere coincidence that in nearly every reported Vincent's infection epidemic, all those involved lived in similar conditions of nutrition, hygiene and housing.

The elements involved in the lowering of tissue tone can be grouped under two general headings, local and systemic. Let us study some of the local causes first.

Lack of Oral Hygiene.—There is no more important single agency contributing to acute Vincent's infection than a low standard of oral hygiene. By far the greatest number of acute causes can be attributed to this condition alone. Calcareous deposits are lodged just under the gingival crevice, usually interproximally. In addition, soft débris is packed into this area, and together these irritants rob the gingivae of the power to resist the rapid proliferation and growth of the fusospirochetes. Not only do these deposits cause the gingivae to become swollen and thus present a mechanical

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trap for more débris, but they also cause a local cyanosis. This lowers tissue resistance even more effectively to the inroads of a revivified strain of bacteria, well entrenched in a favorable incubation zone. It is significant to note, in this connection, that even the most conservative clinicians advise a thorough scaling in each case before dismissal. Now it must be obvious to every one that the only result to be hoped for in such a procedure is the raising of tissue resistance.

Kronfeld reports that calcareous deposits lying in contact with the crevice epithelium, even in shallow crevices, cause breaks and ulcerations in the continuity of the tissue.[8] This suggests the possible explanation of the interproximal

Fig. 1.—Acute Vincent's infection before treatment.

Fig. 2.—Case shown in Figure 1; thirty-six hours after initial treatment.

destruction so often seen in Vincent's infection. The coalescence of the crevicular ulcers interproximally and their subsequent infection by fusospirochetes may possibly explain the papillary loss and ulcerations in acute cases.

There is a large body of opinion that Vincent's infection, even subacute or chronic, is a filth disease. This has been proved by experience to be essentially true. It must not be assumed from this, however, that this condition is always due to lack of effort and care by the patient. Let us turn to anatomic considerations. The gingival margin in health presents an unbroken, knife-edged sheath to the clinical necks of the teeth. Gingival tissue is extremely tough and resistant. In such a state, it resists any mechanical invasion of the gingival crevice. In any metabolic imbalance of this tissue, the first manifestation is a rounding and blunting of this gingival margin. Now, instead of a sharp, knife-edged gingival line, we have a rounded one. Such a margin presents an open-mouthed funnel through which débris is naturally packed into the gingival crevice. It may be seen from this that even filth may be a secondary factor.

Faulty Dental Restorations.—It is commonly recognized that any dental restoration, be it a crown, inlay or clasp, that impinges on the gingival tissue, causes tissue deterioration and invites Vincent's infection or other periodontal disease. Open contacts also offend in this direction. What is not so generally recognized, however, is the importance of anatomic carving in all dental restorations. Very often, a tooth is restored to good contact with its neighbor, but with no definite carving of the proximal marginal ridge. Such a restoration offers little protection to the interproximal papillae. Since the food being masticated is not directed by inclined planes *away* from the marginal ridge toward the center of the tooth, it does not take long for the food to become wedged, even with a good contact point. From that time forward, the course is the same as with a poor contact.

Third Molar Flaps and Periodontal Pockets.—These two causal factors are presented as one because they exhibit the same characteristics in regard to Vincent's infection. This does not imply that they are similar pathologically. They constitute an excellent primary incubation zone. Davis and Pilot report that rich cultures of fusospirochetes are found in every periodontal pocket examined.[4]

SYSTEMIC FACTORS

There are a number of systemic conditions which, according to present information, promote Vincent's infection, mainly by impairing tissue tone.

Vitamin Deficiencies.—It is not the purpose of this paper to evaluate in meticulous detail the effect of low vitamin intake on gingival tissues. There is, however, incontrovertible evidence that lack of the vitamin B complex particularly, and to some extent vitamin C, has a profound effect on the incidence of Vincent's infection. It has long been known that lack of vitamin C causes capillary friability and epithelial degeneration, as revealed in the oral mucosa and other tissues. True scurvy exhibits interesting oral manifestations that resemble Vincent's infection to a limited extent. It is, however, vitamin B complex, and more specifically nicotinic acid, which interests us especially in relation to Vincent's infection.

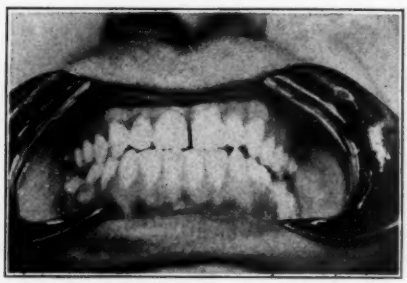

Fig. 3.—Case shown in Figures 1 and 2; four days after initial treatment.

Tunicliff and her associates, in 1936, demonstrated that dogs on a black tongue (pellagra in man) diet always developed Vincent's infection.[5]

Denton, in 1925, reported that, in each of his pellagra cases, there appeared necrotic lesions of the oral epithelium.[6]

Thoma, in an interesting case report, described a case in which there appeared an ulcerative lesion in the lower third molar area. A smear from this region showed a thick bed of fusospirochetes. One hundred milligrams of nicotinic acid was administered daily. With no local treatment, the lesion promptly disappeared and the area gave a negative smear.[7]

Thoma reports another case, this one a recurring acute Vincent's infection in which all local treatment failed. On the administration of nicotinic acid, prompt and permanent recovery followed.

Fig. 4.—Hormonal gingivitis. This type of gingivitis closely resembles the proliferative type of Vincent's infection. (Compare Fig. 1.)

There are appearing an increasing number of such case reports in the dental and the medical literature. In this connection, it might be interesting to mention that excessive use of alcohol has long been thought by many to be an important etiologic factor in fusospirochetal infections. Since the deleterious effect of alcohol on the nicotinic acid content of the blood is well known, this may be yet another indication of the profound effect that subclinical pellagra—or, at

any rate, a low nicotinic acid index—may have on the gingivae.

Hormonal Imbalance.—Hormonal gingivitis is often mistaken for Vincent's infection since some of the manifestations are similar. It is, however, not rare to find actual Vincent's infection superimposed on hormonal gingivitis. Since a low estrogenic hormonal output results in the loss of gingival keratin and in epithelial degeneration, it is not surprising to find these gingivae lowered in tone and open to auto-infection by the ever present fusospirochetes. Ziskin reports that in female castrated monkeys, Vincent's infection was found grossly and confirmed bacteriologically in many cases. He further reports that in human female castrates, several subacute and one acute case were manifested.[8]

We can see that the influences exerted on tissue tone are many, and in each may lie the etiologic factor of a given Vincent's case. In fact, any agency, be it avitaminosis, hormonal imbalance, purely local conditions or general physical debility having a variety of causes, can become the underlying etiologic factor. In this direction, it may be well to refer to a monograph by Francis H. Daley in which the high incidence of Vincent's infection in the spring of the year is pointed out.[9] General physical debility, whether due to fatigue, lack of sunshine and exercise, to a surgical operation or to any other of the many conditions involved in it, can also be the underlying cause of Vincent's infection.

From this perspective, the many chronic, recurring and stubborn Vincent's cases should not present quite so baffling a mystery as they do. The scope of the disease has been widened considerably. Moreover, the periodontist is being forced to make a more general approach to the problem.

DIAGNOSIS

The symptoms by which Vincent's infection is recognized are fairly well standardized. It is well, for reasons of clarity, to attack the subject of symptomology in the three degrees in which the disease manifests itself.

Acute Vincent's Infection.—The cardinal signs of acute Vincent's infection are generally well known. Intra-orally, the symptoms are particularly violent. The mucosa is highly inflamed, with engorgement of the interdental papillae. Occasionally, there is ulceration of these papillae, and they are covered with a gray pseudomembrane, which is easily removed, leaving raw, bleeding tissue exposed. The papillae are usually inverted and present a crater-like appearance. There is a characteristic fetid odor and the accumulation of detritus is considerable. Occasionally, the fauces and even the tonsils may be involved. The tissues affected are always painful. Systemically, the disease is expressed in a slight rise in temperature and a feeling of general malaise. The patient usually suffers from swelling and cracking of the lips, considerable salivation and a metallic taste.

The differential diagnosis in this stage of the disease does not present many difficulties. The symptoms and the extreme pain usually suffice. Some diseases with which it may be confused are:

1. Blood dyscrasia. In these cases, pain is not usually the outstanding symptom. A blood examination makes diagnosis easy.

2. Diabetes mellitus. This disease, in its oral manifestations, is not partial to the interdental papillae as is acute Vincent's infection. In addition, the acetone breath, the absence of pain and the soft tissue abcesses in typical cases should serve in differentiation even if a blood sugar index is disregarded.

3. Metallic poisoning. The gingival symptoms in metallic poisoning are fairly constant throughout the buccal gingivae. There is no differentiation in involvement interproximally as there is in acute Vincent's infection. The metallic line

in the gingivae and the absence of pain are also decisive factors.

4. Severe gingivitis. The gingivae in acute gingivitis are not painful. The intensity of involvement is constant. There is no differentiation interproximally, and there is no pain.

5. Hormonal gingivitis. In this type of gingivitis, the symptoms sometimes resemble those of acute Vincent's infection. There is interproximal involvement, which at times may appear to be acute. There is, however, no pain and no fetor. The blebs and desquamations sometimes manifested are occasionally seen interproximally. There is much more danger of confusing hormonal gingivitis and subacute Vincent's infection than there is in the acute stage.

Subacute Vincent's Infection.—The subacute stage of Vincent's infection is far more common today than is the acute infection. Many of these cases are missed entirely by the careless diagnostician. Usually, only the papillae are affected, presenting a rose or bluish discoloration; and there may be some splitting of the papilla mesiodistally from the crest downward. While the patient may not complain of pain as a subjective symptom, the probing of these areas is painful. There are usually no other symptoms. The remark is often made that if we do not see many of these cases in the average busy practice, it is because they are missed as the result of a lack of important and spectacular signs.

The differential diagnosis in these cases should not give much trouble. Pain is the constant factor. In simple gingivitis, there is even involvement of the gingivae and no pain. In hormonal gingivitis, there may be interproximal symptoms, but there is no pain. There are no other common syndromes with which subacute Vincent's infection may be confused.

Chronic Vincent's Infection.—In this stage, Vincent's infection is easiest to recognize and is eradicated only with the greatest difficulty. A case will reach the chronic stage when it has either been untreated in its acute or subacute form, or has been incompletely treated. In the chronic form, the scars and disfigurement of Vincent's infection are manifested. Morphologically, the signs are as follows: The gingivae present a cyanotic, pale appearance. There is no inflammatory reaction. Interproximally, there is frequently no tissue at all, just an open crater extending down to the level of the alveolus. In these cases, there is sometimes a mild osteomyelitis affecting the uncovered bone. The labial and lingual gingivae are merely curtains unconnected interproximally. They may even be drawn away from the necks of the teeth to some extent. In other cases of this type in which there is not quite so much destruction, there exists papillary inversion—hollowed-out craters in the place of papillae. There is usually some recession. These cases regularly give rise to a severe periodontoclasia, which then enters the picture as a complicating factor. A considerable number of chronic cases are invaded by a fungus, which sometimes presents problems in treatment.

There seems to be an acid area about the necks of the teeth in these chronic cases. Very often, the operator will find exposed roots of the involved areas rubbery and decalcified, and presenting caries encircling the root. There is very little, if any, pain and, in the uncomplicated case, no pus. The absence of pus, which is alkaline, may explain the root decalcification. It is certain that this rarely happens in suppurative periodontal disease.

TREATMENT

The conservative, accepted treatment for Vincent's infection consists of two distinct phases. First, the gingivae and oral mucosa are subjected to careful topical application and lavage by some favorite specific. In most cases, the drug of choice in this method is one of three

types—the oxidizing agent, the arsenical or the spirillicide. Only after the acute symptoms have disappeared is careful scaling performed.

The rationale of this method of treatment is that scaling in an acute case is a dangerous procedure, so dangerous, in fact, that the very life of the patient may be in jeopardy. It is felt by the proponents of this system that the trauma, with its concomitant hemorrhage, which always follows any manipulation of the tissues in acute cases, may cause a fuso-spirochetal infection of the blood. I have never seen published any standardized, authenticated evidence in support of this concept.

There is, on the other hand, a growing body of evidence that points irrefutably to an opposite conclusion; that is, that immediate scaling and curettement have only the most salutory effect on the tissues locally, and no undesirable results systemically. This phenomenon can be explained only by reexamining our basic concept of the disease.

If we regard Vincent's infection as an infection primarily, the conservative approach is the only logical one. First, the reduction of sepsis should be accomplished and then the resistance level of the host should be raised. On the other hand, if we consider Vincent's infection to be a symptom of low tissue tone, the only rational procedure is to improve the tissue tone immediately. There is no better method of accomplishing just that than immediate curettement.

Theodore B. Beust, one of the pioneer investigators of Vincent's infection, writes in this connection:

> We have learned from microscopic examination that, in this lesion, the interdental spaces and gingival pockets are filled with a teeming mass of virus. Notwithstanding this knowledge it is common practice to handle these cases gingerly—to trust to the defenses of the patient to ward off the onslaught. The treatment given by the average practitioner is practically useless. Superficial applications will never affect the organisms in the interior of the pocket. These concealed armies are the real offenders. If the best is to be done for the patient then the activities of the organisms must be immediately suppressed. The hemorrhage incident to an immediate energetic treatment disperses the bacteria and their products, reduces the hyperemia, and affords almost instantaneous relief to the patient. If the pockets are evacuated and left surgically clean, the much feared spread of the infection will never occur.[10]

Since most authorities who advocate the therapeutic management of Vincent's infection also advocate curettement after the acute stage has passed, the difference between the two systems of treatment seems slight. This, however, has not been found to be true. A considerable number of cases of "recurrent" Vincent's infection and of periodontal disease result from incomplete treatment of cases. This is possible in conservative treatment, in a variety of ways. For one thing, patient cooperation dwindles with the reduction of acute symptoms. Again, the operator is likely to become careless with such a routine addendum as scaling. Third, in an acute case, prolonging the period of treatment leads to chronicity. And it is in this chronic stage that the disease is most difficult to treat successfully.

Let us examine the theory regarding the danger of immediate curettement leading to infection of the blood stream. It is known that one of the principal strains of bacteria inhabiting the dental abscess and the periodontal pocket is *Streptococcus viridans,* a dangerous organism and the chief offender in subacute bacterial endocarditis. Any instrumentation sends showers of these organisms into the blood stream. To date, I have not heard any one advise against pocket curettement on that score. And yet cases of subacute bacterial endocarditis, an almost invariably fatal disease, are known to have been caused by the presence of these organisms in the

blood stream in conjunction with an already damaged heart valve.

In an excellent treatise on this subject, Clagett and Smith point out that each dental extraction releases myriads of *Streptococcus viridans* into the blood stream. Not only are these organisms released: they are pumped into the blood stream by the luxation of the tooth. This results in a temporary bacteremia, which has been called the "bacterial tide." A previously damaged heart valve is prone to infection during this period. However, the bacteremia invariably disappears after a few minutes. In other words, there is no appreciable effect on the blood stream. Clagett and Smith point out further that even where there was no tissue manipulation whatever, they recovered blood cultures of *Streptococcus viridans,* although these were not so massive as those recovered during the "bacterial tide."[11]

From the foregoing, we can deduce much that is interesting. No one would contend that there is as much violence during curettement as there is during a dental extraction. Luxation of a tooth acts as a pressure pump on the virus at its apex. Yet no septicemia results. Why should it occur after curettement?

Since the discovery of phagocytosis, it would seem that the true rôle of the blood in infections would be clear. It is the main defense against the spread of any infection. Why would the blood behave differently in the case of Vincent's infection from its manner of behavior in any other condition?

Cahn, in a monograph on the powers of penetration of the fusospirochetes, points out that the organisms are found even in the corium of the gingivae.[12] This fact removes any possible scientific basis of the theory of non-curettement from fear of carrying the organisms deeper into the tissues. In addition, it reduces to mere fancy the elaborate routine developed by some investigators who use drugs of low surface tension to "reach" the fusospirochete, but warn against early curettement.

Two continental investigators reported that topical application of carotin had excellent results even when there was no vitamin-A deficiency in the blood. As if in after-thought, they mention that curettement always preceded the therapy. There can be no doubt of the efficacy of such treatment. Any substance would do as well if used in the same sequence.[13]

Arthur H. Merritt is one of the few clinicians who have developed a completely rational technic in the treatment of Vincent's infection. For years, he used immediate curettement in combination with drugs, with excellent results.[14] In an effort to determine how important a rôle drugs played in these results, I have, for the past four years, treated acute Vincent's cases with no drugs whatever in office treatment. In each case, no matter how acute, curettement was as complete as possible. That and nothing more. The patient was instructed in the home use of toothpicks interproximally, to dislodge any new débris packing into these areas. In addition, the bleeding caused by pressure interproximally was found to have a mechanical flushing effect. It might not be amiss to state here that the use of the toothpick is discontinued after three or four days. It should not be a part of the prophylactic equipment of the normal patient. The patient is also instructed in the use of hydrogen peroxide in a 50 per cent solution with water for frequent flushings of the mouth and teeth. Here too, the mechanical action of the frothing hydrogen peroxide was found to have a salutory effect in keeping the gingivae free of detritus.

The results were highly satisfactory. In the average acute case, the patient was dismissed as completely cured after from three to five visits. A complete cure means that all evidence of the disease has been eradicated. These results refer to the acute case uncomplicated by the

scars of previous infections. Careful curettement, as deep as was possible in the individual case, was instituted at the first visit. The results of this treatment were spectacular. All pain and most of the inflammation and swelling succumbed to even partial curettement at the first sitting. The remaining visits were dedicated to finishing the curettement in meticulous detail. Fine, slender curets were used throughout to minimize the pain of tissue displacement.

It must be deduced from this evidence that the use of a therapeutic agent has little effect other than its mechanical flushing action on the free gingival tissue. The very foundation of a rational treatment of Vincent's infection is deep, immediate curettement plus all the mechanical flushing possible in home care.

In the subacute case of fusospirochetal infection, little more is needed than complete prophylaxis and the correction of the etiologic factor. This is of prime consideration in all phases of Vincent's infection.

In the chronic stage, however, certain difficulties arise. Here it is not so much the sepsis, but the scars of the disease that cause trouble. Papillary inversion or complete interproximal tissue loss are serious complicating factors. These must be corrected before the patient can be dismissed.

In papillary inversion, the cupped-out interproximal tissue may often be stimulated to proliferate to a more normal form by interdental stimulation. There are available several rubber tipped applicators that are excellent for this purpose. Should this, in conjunction with proper brushing technic, fail, it may be necessary to resort to surgery. Surgical removal of the affected interproximal tissue and the packing of the area with a surgical dressing is an effective method of achieving the proper papillary form. The disadvantage here lies in that some recession is nearly always present. However, a normal papilla, even though it is somewhat above the contact point, is to be preferred to a normal gingival level with inversion.

In those chronic cases in which there is complete interproximal tissue loss, it is almost always necessary to resort to surgery. The technic used is the same as that outlined above. It must be kept in mind that the periodontist's responsibility does not end until the case is entirely free from any vestiges of the disease. Residual matter will always serve as a focus for recurrence of Vincent's infection or for other periodontal disease. It is not enough to reduce the infection. Treatment should be carried out with energy until there is no evidence of the disease. In addition, it should be kept in mind that unless the etiologic factor is found and corrected, all treatment is merely temporary. The disease will recur.

CONCLUSION

Vincent's infection is a symptom of lowered tissue tone and should be treated with that fact in mind. If we could forget all about the infection and concentrate on the gingivae, one of the greatest obstacles to rational treatment would be overcome.

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THE PRACTICAL APPLICATION OF MECHANICAL BRIDGE FIXATION

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FOR the past thirty-five years, in fact ever since the inception of the casting process, we have persisted in the attempt to retain fixed bridges with simple intracoronal inlay attachments, though we have been fully aware of their speculative retentive qualities and susceptibility to dislodgment.

It is no secret that the persistent use of this type of bridge attachment is based on its comparative ease and precision of construction and its biologic advantages. But the inadequacy of retention of these conservative attachments, with cement-friction anchorage, has remained throughout the years a problem which we have attempted to solve by substituting more destructive and more difficult attachments involving a large number of surfaces of the teeth.

Now the simple technic for the mechanical fixation of elementary inlay attachments makes it possible to use them with a new certainty of retention. Insufficient retention, their prime shortcoming in the past, can now be easily overcome by quickly and superficially locking them to the abutment teeth after the bridge has been constructed and cemented to place in the mouth. Thus, the retentivity of the inlay attachments is more than doubled by the addition of mechanical to the ordinary retention afforded by cementation.

The basic principles of mechanical fixation and the new principles employed in this technic having been previously described, [1, 2] the purpose of this paper is entirely practical: to make specific recommendations regarding the particular types of conservative preparations that can now be used successfully in all the various teeth: molar, bicuspid and anterior, and also the types of locked attachments used in each kind of abutment tooth to support one, two, three or four pontic bridges, and to serve as a complete practical guide to mechanical fixation. These instructions follow a brief review of the technic to make its practical use intelligible to all.

The bridge is constructed in the usual manner, but with more conservative attachments, and is cemented to place in the mouth without its porcelain facings attached, to afford generous access to the buccal and labial margins for lock-cavity preparation and lock application. (Fig. 1.)

A very small precision gold pin, only

1.25 by 1.75 mm., with a beveled head is placed superficially on the buccal or labial margin of the retainer, half in the tooth structure and half in the gold to afford genuine locking, at a right angle to the direction of exit of the casting from its prepared cavity and perpendicularly to the surface of the tooth. (Fig. 2.)

Reversing the precision inlay procedure, with new type precision drills, cylindrical beveled lock cavities of exact predetermined lock-pin dimensions are cut.

The little handle on the preformed gold pin makes manipulation of so small a piece very simple. The handle is snipped off by hand pressure with the

Fig. 1.—A, labiobuccal view of lower first bicuspid semifixed bridge cemented to place without its porcelain facing to provide generous access for lock-cavity preparation that followed on buccal and labial margins. After the lock pins have been cemented, the facings are placed. B, linguoclusal view of same bridge.

rongeur or small wire cutter by which it is held for cementation, all in one movement, when it has been seated. Cementation of the porcelain facings completes the bridge.

The resistance of the little pin to shearing securely retains the casting and would lock it to the tooth even if the attachment were uncemented. A locked mesioclusodistal attachment (Fig. 3) is more retentive than any of the more destructive and difficult cement-anchored attachments that we have been using.

The surreptitious torques that dislodge bridges are mechanically resisted, and now the cement bond between the tooth and the attachment cannot give way. This prevents caries under attachments. Besides, the casting is securely locked against any movement in the only direction in which it can come away from the tooth, its direction of exit from the cavity.

LOCKED ATTACHMENTS USED IN MOLARS

The elementary preparations used in molars with mechanical fixation are mesioclusal, mesioclusodistal, mesioclusobuccal and mesioclusolingual; also the three-quarter crown. (Fig. 4.) Molar

Fig. 2.—Lock cavity prepared on labial margin of key-receiving attachment in cuspid, half in gold and half in tooth structure. The pin placement is at a right angle to the usual direction of inlay pins, for genuine locking. The handle permits easy manipulation, removal after verification of fit and clean cementation.

retainers almost without exception are locked on the buccal margin of the mesial surface. This affords a convenient angle of approach mesiobuccally for lock-cavity preparation with the straight handpiece by direct vision.

Locking on the buccal or labial margin is always preferred to locking on the lingual margin of any attachment, for two reasons: (1) the convenient convexity of the buccolabial aspect of the arch makes it easy to hold the drills in a true perpendicular relation to the sur-

face of the tooth, and (2) better access to the buccal and labial margins is afforded by the absence of the porcelain facings. Nearly all the various modified retainers now in use have axially inclined margins on which they also can be locked in the same manner.

In the absence of any precluding condition, properly selected two and three surface locked molar inlay attachments will retain with certainty any bridge of correct biomechanical design, even more securely than any of the more complicated or destructive cement-anchored attachments used heretofore. A cemented full crown is not so retentive as a locked mesioclusodistal inlay in either a molar or a bicuspid.

A modification of this technic can be used to lock full crowns also when the teeth for which they are constructed are sufficiently short to make retention by cement alone questionable. Then the lock pin is placed straight through the central part of the buccal surface of the crown, extending into the tooth structure. Here, the gold should not exceed 1 mm. in thickness, so that the pin can just enter the tooth for retention.

If it should be necessary or desirable, the same technic can be applied lingually to any three-quarter crown. However, marginal locking as described is always to be preferred because it is more retentive, shallower and more convenient.

BICUSPID LOCKED ATTACHMENTS

The fundamental box and slice preparations used ordinarily in bicuspids with mechanical fixation are mesioclusodistal and proximoclusal. The three-quarter crown is also used. (Figs. 1 and 3.) These are locked frequently on the buccal margins of the mesial surfaces in the manner of locking molar attachments. But because the bicuspids are farther forward in the arch and may support pontics distally, they are often locked on the buccal margin of the distal surface instead of the mesial. Sometimes, the straight handpiece may be used for lock-cavity preparation on the distobuccal surface of a first bicuspid as if it were an anterior tooth. But on the distal surface of the second bicuspid, it is necessary to use angle-handpiece drills to hold them perpendicularly to the sur-

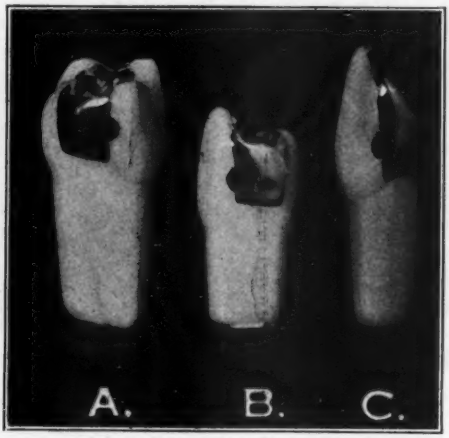

Fig. 3.—Gold attachments with tiny locks in place. A, mesioclusal attachment in molar. B, mesioclusodistal in bicuspid. C, three-quarter crown on cuspid. These reveal the negligible addition of gold, only one-half the little pinhead.

face of the tooth and of the casting.

A mesioclusodistal locked attachment is used more often than any other in bicuspids. Usually, the margin adjacent to the pontic is more accessible whether it is the mesial or the distal. However, even if pontics are supported distally, a mesioclusodistal attachment may sometimes be even more conveniently locked from the mesial aspect if caries requires buccal extension of the margin on the mesial surface. (Fig. 4.)

In bicuspids, mesioclusodistal, three-quarter-crown and all types of modified retainers which include both the mesial and the distal surfaces can be locked either mesially or distally, the choice depending on convenience. Only in the case of a rigid retainer of a semifixed bridge is it necessary always to place the lock on the surface adjacent to the pontic.

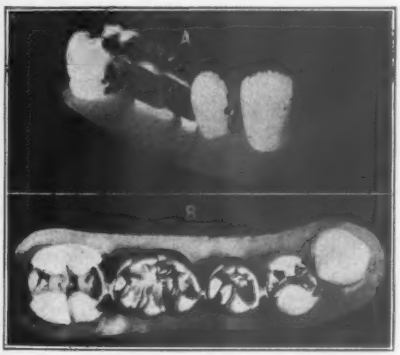

Fig. 4.—A, mesiobuccal view of lower right fixed bridge restoring second bicuspid and first molar; showing lock-cavity preparation on buccal margins of both attachments. In this case, caries had required the buccal extension of the margin on the mesial surface of the bicuspid so that ample access was afforded for lock-cavity preparation on the mesial surface, as shown. B, occlusal view of same bridge.

LOCKED ATTACHMENTS FOR ANTERIOR TEETH

The attachments used with mechanical fixation in anterior teeth are three-quarter crown, mesiolinguodistal and proximolingual. (Figs. 1, 3 and 5.) All, like the properly prepared three-quarter crown, are prepared to exit incisally, the axially inclined walls and margins paralleling the incisal two-thirds of the labial surface of the tooth. This provides axially inclined margins parallel to the direction of exit of the casting easily accessible for locking from the labial aspect. If one prefers, intracoronal attachments for anterior teeth which receive the rest lug of a semifixed bridge can be made to exit lingually and then locked on the gingival margins. But incisal exit is always to be preferred because it makes locking on the labial surface much more convenient and affords greater retention.

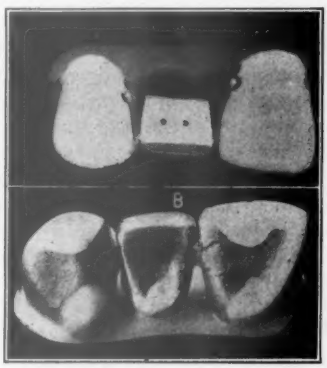

Fig. 5.—A, labial view of semifixed bridge restoring upper lateral incisor. The simplicity of and ease of access for preparing lock cavities in anterior teeth are evident. B, lingual view of same bridge.

In the anterior teeth, locks are placed with equal facility from either the mesial or the distal approach. The straight handpiece can always be used here. Because locking is so easily accomplished on the anterior teeth, fixation of all anterior attachments should be mechanically insured.

Because of their contour, anterior teeth are not so well adapted to the use

of intracoronal inlay attachments as the posterior. Therefore, three-quarter-crown and extracoronal modified retainers are used more often on the anterior teeth. But if their retention is to be fully assured, all three-quarter crowns should be locked. Too often, I have observed yielding of the cement holding well-constructed three-quarter crowns, especially on anterior teeth.

A mesiolinguodistal inlay retainer, which in the past has been utilized primarily to grace textbooks on fixed bridgework as a matter of academic interest, now assumes a broader practical scope of usefulness, especially in favorable cuspids, when locked.

All recommendations for preparations are of a broad, general nature. Often, good dental judgment or personal preference will dictate the use of attachment types other than those described. Extensive caries or high susceptibility may require the use of a full or three-quarter crown instead of the retainer suggested.

In presenting this technic, it is not the desire to overemphasize the mechanical aspects of bridgework. By vastly increasing the retentivity of simple inlay attachments and extending the scope of usefulness of conservative preparations, the biologic advantages truly transcend the purely mechanical improvement.

The three short sections that follow describe the types of minimum locked retainers that have supported one, two, three or four pontic bridges for as long as ten years to date without the failure of a locked attachment thus far.

ONE-PONTIC BRIDGES

When a molar or bicuspid is the abutment supporting a one-pontic bridge, the simplest attachment, a locked proximoclusal, is usually the attachment of choice. A mesioclusodistal attachment is sometimes substituted especially in anatomically unfavorable lower bicuspids.

The semifixed type of construction is nearly always preferred for a one-pontic bridge. Both the rigid and the key-receiving attachment should be locked.

In anterior teeth, a two-surface inlay is never the rigid retainer of any bridge, but it is used extensively to receive the rest lug. (Fig. 1 and 5.) Because so much depends on its security and so much difficulty is encountered in its loosening, the non-rigid attachment should always be locked to any tooth.

In anterior teeth, the rigid attachment for a one-pontic bridge is usually a locked three-quarter crown, though a locked mesiolinguodistal attachment can sometimes be substituted in a long, strong cuspid. (Fig. 5.)

If one prefers, a particular type of modified extracoronal retainer for anterior teeth can be used instead of a three-quarter crown and locked in the same way. However, in the posterior teeth, some type of intracoronal inlay is almost always sufficient to sustain any bridge of biologic span.

TWO-PONTIC BRIDGES

When a bicuspid or a molar is the abutment of a two-pontic bridge (Fig. 4), the fundamental mesioclusodistal, locked, is the attachment preferred over the more extensive, cement-anchored attachments.

In molars that support two pontics, a well-constructed mesioclusobuccal or mesioclusolingual attachment can often be substituted for a mesioclusodistal. The former are easier to prepare and, when locked, afford ample retention.

Under very favorable conditions, a locked mesioclusal attachment has proved entirely adequate in first molars to support two bicuspid pontics for years. However, despite the successful retention of several such cases, I have not the temerity to recommend them for this purpose without definite qualifications.

When an anterior tooth is the abutment for a two-pontic bridge, a locked three-quarter crown is nearly always the attachment used. (Fig. 3.) Now even

central and lateral incisors can be depended on to retain biologically correct two-pontic bridges with a new certainty of fixation.

THREE AND FOUR-PONTIC BRIDGES

We are at times justified in placing a three-pontic bridge from cuspid to second molar or making a four-pontic restoration from cuspid to cuspid. As the span becomes longer, the need for strong retention increases and the indications for locking become even more mandatory. The use of any cement-anchored attachment, regardless of how involved or destructive, is always speculative in these cases.

Usually, bridges with more than two pontics are supported either by molars or cuspids, the other teeth serving usually as piers or for auxiliary attachments.

Even for supporting long-span bridges, the standard mesioclusodistal attachment, locked, is usually adequate in molars. But when these teeth are anatomically or otherwise unfavorable, a locked three-quarter crown may be substituted. The latter, locked, is far more retentive than a cement-attached full crown.

Because of the magnification of torsional and other dislodging stresses in long bridges, the retainer of choice on a cuspid is always an extracoronal type, such as a locked three-quarter crown.

When a biouspid, by virtue of its position in the arch, serves as a pier, a locked mesioclusodistal retainer is usually adequate.

If any one has conjectural misgivings regarding the retentive efficacy of one lock plus cement retention, a second lock can be added on the opposite margin of the attachment. But one lock adds so much to the retentivity of a casting that the indications for the use of a second lock are extremely rare.

TECHNIC FOR LOCKING DISPLACED CEMENTED BRIDGES

It has been stated previously that loosened cement-attached bridges can be recemented and locked securely if caries has not set in and if the quality of workmanship justifies their replacement. The technic is described to facilitate this procedure.

Sometimes, the attached porcelain facing limits access to the margin for locking. This can be overcome in two ways: (1) the facing can be detached by boiling in acid and the bridge be recemented and locked in the usual manner; (2) the facing can be left on the bridge and its angle is disked sufficiently to provide access to the margin to be locked. This can often be accomplished without esthetic loss on the distal angle of molars and bicuspids.

Nothing so convincingly reveals the comparative retentive value of the locking technic as its ability to successfully retain bridges where ordinary cement-frictional retention has repeatedly failed. Here, the true comparison between cement retention alone and plus mechanical fixation can be made under identically the same conditions; the same bridge in the same mouth. However, under no circumstances should the locking technic be used to justify the replacement or the original use of untrustworthy castings.

TECHNICAL IMPROVEMENTS AND ADDITIONS

The use of the handle pin as a precision, immediate gold inlay has been described for the buccal, lingual and occlusal surfaces of molars and bicuspids and the labial surfaces of anterior teeth. Now further uses and improvements in the technic are added.

This technic is superior to any other for restoring quickly and esthetically small carious areas on margins of regular gold inlays.

Immediate gold inlays can, with this technic, often be placed on proximal surfaces, when the absence of adjacent teeth permits holding the handpiece perpendicularly to those surfaces.

Because the pin just enters the tooth structure, the set of the cement may be hastened by contact with a very warm instrument.

A fast-setting mix of cement may be used for the same purpose because the handle on the pin permits quick placement.

The patient's reaction to the novelty and convenience of having a gold inlay placed in a single short sitting is most favorable.

One point should be cleared up. Many have asked why the pin is not tight in its cavity when tried in place. It is not supposed to fit tightly for the reason that this technic for reversing inlay procedure represents a new method for securing superior inlay margins. Since the pin is 0.003 inch short of the floor of the cavity, it is stopped when cemented to place, not by the end of the pin, but because of the contact of its beveled head with the beveled surface margin of the cavity for intimate marginal seal. The diameter of the pin is 0.002 inch less than that of its cavity, to permit the escape of all excess cement for full seating at the margin and close adaptation at that important place.

The combination of oversize drills and handle pins, slightly larger in diameter, facilitates recentralization of a lock cavity on a margin should it ever be necessary and is used for slightly larger immediate gold inlays. If necessary, the pins can be easily and quickly removed by the drills used for preparation of the cavities.

This technic is submitted without pretence that it is in any way abstruse or that there is any need to take a special course to use it successfully. Already large numbers are using it with excellent results, with only a clinical demonstration or a study of the literature as a background.

CONCLUSION

Present-day attachment construction has not so closely approached biomechanical perfection as has modern pontic construction. This technic is aimed at the most significant remaining shortcomings of the former.

After our unfortunate experiences with cement-friction retained inlay attachments, it will probably take a long time to universally establish the fact that a little superficial lock pin placed at a right angle to the usual direction can add much to the retentivity of the simpler bridge attachments.

It is not the intent even to suggest that this technic has any of the elements of a panacea. The biomechanical requirements to be fulfilled in the construction of a fine bridge are far too many and too varied.

However, it is hoped that the biologic advantages and greater security afforded by this technic will lend a fresh impetus to the restoration that affords maximum satisfaction to the patient: a well-constructed fixed bridge.

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ANODONTIA: REPORT OF A CASE

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CLINICALLY, cases of anodontia may be divided into two groups: (1) complete anodontia, in which there is a complete congenital absence of teeth, either deciduous or permanent, or both, in either the maxillae or the mandible, or both, and (2) oligodontia, or partial anodontia, where one or more of either the deciduous or the permanent teeth in either jaw are congenitally absent.

Complete anodontia is rare. In 1883, Guilford[1] reported the case of a man 48 years of age, who said he had been edentulous from birth. While x-ray films were not available to the profession at that time, the report shows articulated models of the jaws.

In 1904, William Rushton[2] presented photographs and models of a 16-year-old boy who apparently had no erupted teeth. X-ray films were not taken.

In 1924, Cerny[3] reported the case history of a girl 12 years of age whose teeth erupted as follows:

At age 6 months					A		A					
At age 18 months		E		A		A		E				
At age 7 years		E			1		1		E			
At age 10 years	6	E			1		1			E	6	

Complete absence of both deciduous and permanent teeth in the lower jaw was verified by x-ray examination.

In 1928, Cautley[4] examined the mouth of a boy aged 20 years, who had only deciduous teeth present. No x-ray films were taken.

In 1933, Hill[5] reported the case of a boy 6 years and 4 months of age wherein the x-rays revealed two permanent tooth buds in the region of the upper incisors and one tooth bud in the lower left molar region. There were two widely separated cone-shaped teeth in the region of the upper incisors and one upper right molar. No teeth had erupted in the lower jaw.

In 1934, Nager[6] reported the case of an 8-year-old boy in whom the fact that no teeth had erupted was verified by x-rays.

In 1936, Battersby[7] reported the case of a child 9 years and 4 months of age with the complete absence of both deciduous and permanent teeth. The condition was verified by x-rays.

In 1938, Schultz[8] reported the case of a 3-year-old girl with complete absence of the deciduous teeth. No x-ray films were taken.

In 1938, Warr[9] reported the case of a 12-year-old boy with the upper right and left deciduous lateral incisors and all permanent teeth congenitally missing. The condition was verified by x-rays.

In 1939, Cook[10] reported the case of an 18-year-old boy in which x-ray examination indicated complete absence of teeth in the lower jaw.

Partial anodontia is not so rare. It may range from the congenital absence of one or more permanent lateral incisor teeth up to the congenital absence of thirty permanent teeth along with several deciduous teeth. The following cases showing the teeth present and the teeth congenitally absent are reported:

In 1934, Campbell[11] reported a study of congenitally absent lateral incisor teeth, together with x-ray confirmation.

In 1934, Gardner[12] reported the case of a boy 15 years of age with the following teeth present as verified by the x-rays:

R 7 6 C 1 | 1 C D 6 L
6 4 C A | A B C 4 E 6

In 1936, Steurer[13] reported the case of an 11-year-old girl with the following teeth present as verified by the x-rays:

R 1 | 1 L
6 | 6

In 1937, Dahlberg[14] reported the case of a 12-year-old boy with the following teeth present as verified by the x-rays:

R 6 E D C 1 | 1 C D E 6 L
6 E D C | C D E 6

A sister of this boy had the following teeth missing:

R 6 4 2 | 2 4 L
2 1 | 1 2

Of these, the upper right first bicuspid and molar and left first bicuspid had previously been extracted.

In 1936, Porter[15] reported the case of a girl 13 years of age with the following teeth present as verified by the x-rays:

R 6 C | C 6 7 L
E D C B | A B D E

A brother of this girl, aged 15, had the following teeth:

R 7 6 3C 1 | 1 C 6 7 L
7 4 3 2 | 1 2 3 4 7

In 1938, Sly[16] reported the case of a 12-year-old girl with the following teeth congenitally absent:

R 2 | 2 L
5 | 5

A younger sister had the lateral incisors congenitally absent. These cases were verified by x-rays.

In 1938, Gray[17] reported the case of a 9-year-old boy with the following teeth present as verified by the x-rays:

R E C 1 | 1 C E L
E D C A | A C D E

In 1939, Werther[18] reported the case of a 15-year-old girl with the following teeth present as verified by the x-rays:

R 6 C 1 | 1 C L
C | C 4 6

This case gave a history of the extraction of several deciduous teeth. In this report, Werther presents a study of 1,000 children between the ages of 3 and 15 years of age of whom 2.3 per cent had

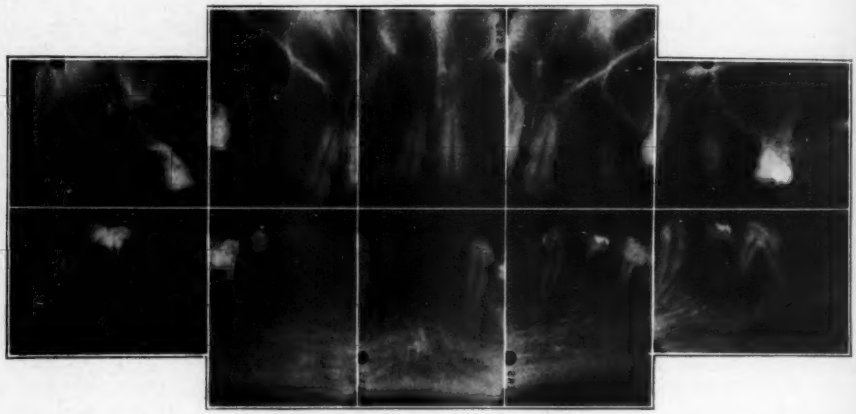

Fig. 1.—Case of Mrs. M. P., aged 20. Thirty permanent teeth were congenitally missing.

congenitally absent teeth, with an average of three congenitally missing teeth for each child affected. He compares his findings with those of Dolder, who, in 1936, examined 10,000 Swiss children between the ages of 6 and 15 years of whom 3.4 per cent had congenitally absent teeth, with an average of two congenitally missing teeth for each child affected. Werther explains this difference as probably being due to the fact that Switzerland has a much higher rate of thyroidism than the United States (vicinity of Philadelphia).

In 1940, Beilock[19] reported the case

Fig. 2.—Case of Mrs. M. P., showing relation of upper to lower dentition in centric position.

of an 18-year-old girl with the following teeth present as verified by the x-rays:

R—			E	5	3	1	1	3			7			—L
	7			3	2	1	1	2	3	4	5	7	8	

In 1941, Edwards[20] reported the case of a 14-year-old girl with the following teeth present as verified by the x-rays:

R—	6			C		C			6	7		—L
		E	D	C	B	C	D	E				

Other cases verified by x-ray examination were reported by Thannhauser[21] and Lord.[22]

The etiology of anodontia is obscure. Several theories have been advanced, such as rickets, tuberculosis, syphilis, endocrine dysfunction, diet and hereditary transmission. The evidence presented by the hereditary school of thought in support of its contention is the strongest, but is not entirely conclusive.

In 1888, Fackenheim[23] reported the case of a family nine members of which, through four generations, had but six teeth each. There were four matings of

Fig. 3.—Appearance of patient in case illustrated in Figures 1 and 2; showing relative development of masticatory apparatus and entire head.

normal with affected persons which produced twelve normal and seven affected persons with many congenitally absent teeth.

In 1921, Thadani[24] reported a study on heredity covering a tribe in India known as Bhudas, the males of which had no teeth. They were further characterized by baldness and extreme sensitiveness to heat. None of the tribal females have been found with the condition of anodontia. The condition is

ascribed to sex-linked inheritance. X-ray pictures were not taken.

In 1929, Aoki[25] made a report on four members of a family, through three generations, wherein one member had fifteen congenitally missing teeth and another had nineteen missing teeth. Two matings of normal with affected persons produced two normal and three affected children. No x-ray pictures were taken.

In 1932, Roberts[26] published an account of a family wherein ten males

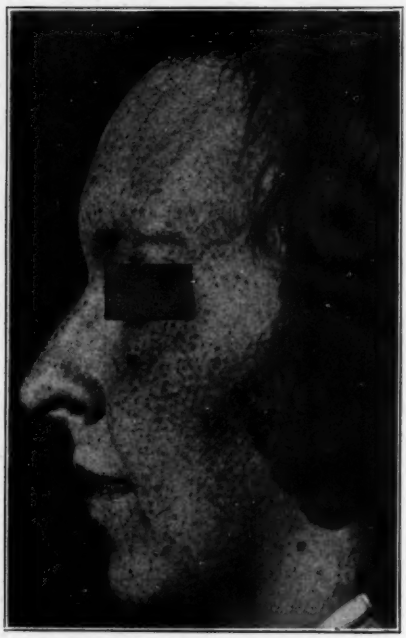

Fig. 4.—Case illustrated in Figures 1-3; relative development of mandible and maxilla.

through six generations lacked many teeth. All cases were verified by x-rays.

In 1935, Keeler[27] made a study of fifty-two pedigrees in dental anomalies, thereafter placing them in seventeen categories, and, in fifteen of these, found abundant evidence of hereditary factors. X-ray pictures were not submitted.

REPORT OF CASE

History.—In July 1939, a married woman, aged 23, reported for routine dental treatment. The chief complaint was looseness of the upper left deciduous lateral incisor, and "soreness of that tooth on jarring as caused in running." The patient was of French descent and her father and mother were first cousins. Her mother, about two years after the birth of the patient, was operated on for the removal of a goiter which had been present for several years.

The patient had had mumps, chickenpox, whoopingcough, diphtheria and measles between the ages of 3 and 5 years. According to her family, she was born with several deciduous teeth. She had two brothers and one sister, all older than she was.

Examination.—The patient weighed about 105 pounds and was 4 feet 11 inches tall. She had a fair appetite. She was occasionally subject to excessive thirst and headaches and seldom perspired. She was subject to shortness of breath. The vision in the left eye was poor and somewhat inferior to that of the right eye. All remaining general findings were normal.

On examination, the following teeth (Fig. 1) were found present:

R—		E		C		1	1	B	C		E			—L
		E	D	C	B	A	A	B	C	D	E			

The upper left deciduous lateral incisor and cuspid had gingival fillings, with recurrent decay, and the upper left deciduous second molar and lower left deciduous first and second molars had distoclusal fillings with recurrent decay. At the age of 13, the patient recalled, the fillings were inserted and the upper right and left deciduous first molars extracted. She could not recall when the upper right deciduous lateral incisor was lost.

Reexamination, in 1942, revealed decay in the lower right first deciduous molar. In the interval between the first and second examinations, the patient gave birth to a daughter, now aged 19 months, and when last observed, in June 1942, was in the eighth month of a second pregnancy.

A Wassermann test was negative. The patient brushed her teeth once daily, using the up-and-down method.

In centric position, the bite was confined solely to contact of the deciduous molar

teeth. (Fig. 2.) The development of the jaws seemed to indicate that the mandible was underdeveloped in relation to the maxillae. (Figs. 3 and 4.) (Craniofacial measurements of the case, by Dr. Milo Hellman, will be reported in a study now being conducted by Dr. Moses Diamond and Dr. Hellman on masticatory development, of which this case is one among many that will be presented.)

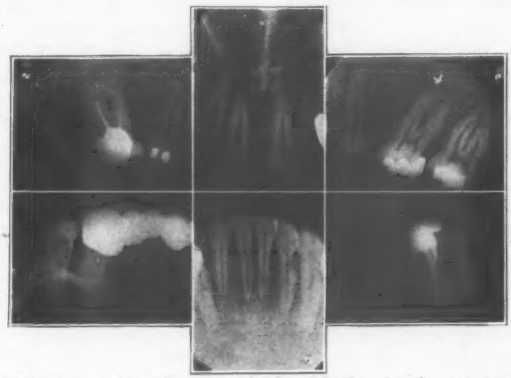

Fig. 5.—Case of M. H., aged 33, brother of Mrs. M. P.; showing congenital absence of ten permanent teeth.

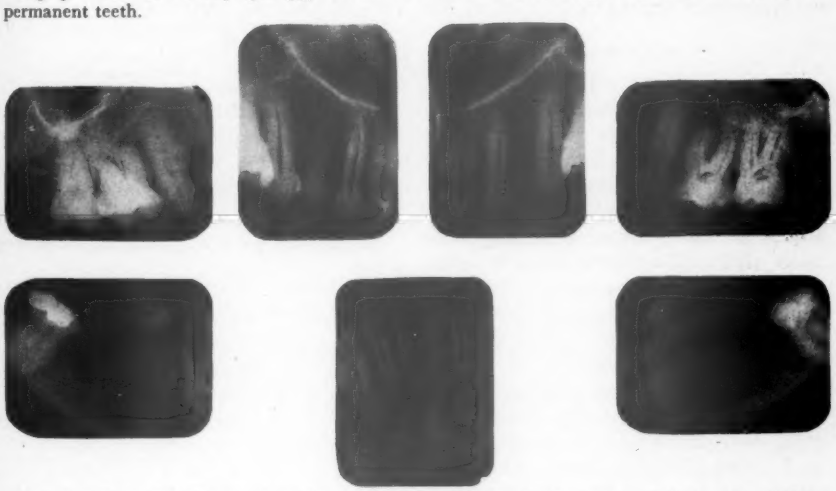

Fig. 6.—Case of L. H., aged 29, brother of Mrs. M. P.; showing congenital absence of fifteen permanent teeth.

E. N., a sister, married, aged 35 years, has four children living, one deceased. The dentition of the four children, aged 5, 7, 10 and 13 years, is normal. No x-ray pictures were available. The dentition of the patient's sister was probably normal. All the upper teeth had been removed in 1939, with no x-ray pictures available. All lower permanent teeth, with the exception of the molars on both sides, which had previously been extracted, were present. The condition was verified by the x-rays. The sister was 5 feet 5 inches tall and weighed 124 pounds. All physical findings were normal and the Wassermann reaction was negative.

M. H., a brother, aged 33 years, married, height 5 feet 10½ inches, weight 178 pounds, gave a negative Wassermann reaction and

all physical findings were normal. One daughter, aged 4½ years, had a normal deciduous dentition. The patient's brother's dentition, verified by the x-rays (Fig. 5), was as follows:

$$R\ \frac{7\ 6\quad\quad 3\ 2\ 1\ |\ 1\ 2\ 3\quad\quad 6\ 7}{7\ 6\quad 4\ 3\ 2\ 1\ |\ 1\ 2\ 3\ 4\quad 6}\ L$$

There are ten permanent teeth congenitally absent.

L. H., a brother, married, aged 29 years, height 5 feet 8 inches, weight 147 pounds, gave a negative Wassermann reaction and all physical findings were normal. The dentition as verified by the x-rays (Fig. 6) was as follows:

$$R\ \frac{6\ E\ 3\ C\ 2\ 1\ |\ 1\ 2\ 3\quad E\ 6}{6\quad 4\ 3\ 2\ 1\ |\ 1\ 2\ 3\ 4\quad 6}\ L$$

The brother had had the lower right and left deciduous molars extracted. There were fifteen permanent teeth congenitally absent.

The mother of this family died about December 1918, and we have no record of her dentition. The father died about 1938, and his dentition was normal.

CONCLUSION

The dental history of this family discloses that the father's teeth were probably normal. There is no record of the mother's dentition. The mother was operated upon for the removal of a goiter in 1918 and died shortly thereafter. She had suffered with this endocrine dysfunctional disease for many years prior to the operation. We may reasonably assume that the endocrine disturbance was progressive in intensity with the passage of time.

The first child, born in 1907, showed a possible normal dentition. The second child, born in 1909, had ten permanent teeth congenitally missing. The third child, born in 1913, had fifteen permanent teeth congenitally missing. The fourth and last child, born in 1916, had thirty permanent teeth congenitally missing.

Of six living children of the third generation ranging in age from 20 months to 13 years, all had normal dentitions for their respective ages.

The evidence indicates that anodontia is largely influenced by heredity, and at least to some degree by endocrine dysfunction.

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PHOTOMICROGRAPHY IN FULL COLOR

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PHOTOMICROGRAPHY is an important photographic technic for the dentist and dental research worker. Since most specimens are stained to bring out tissue structure more clearly, full color reproduction provides the most effective rendition. The ease and simplicity with which Kodachrome film can be utilized and the added impressiveness of the material for educational and clinical use, as well as for record purposes, combine to make color invaluable in dental photomicrography.

FILM

Two types of film are used in full color photomicrography: 1. Kodachrome Film, Type A, which is available in 35 mm. and Bantam rolls, is balanced for light sources operating at 3450° K. 2. Kodachrome Professional Film, Type B, in all standard sheet film sizes, is balanced for light sources operating at 3200° K.

LAMP UNIT

The lamp unit must have a housed light source and, if possible, a condenser, a cell for distilled water and a diaphragm. If it does not have the last, a camera shutter with diaphragm can be placed in the light beam near the lamp condenser, or be attached to the water cell, to serve as both lamp diaphragm and exposure shutter.

LIGHT QUALITY

Light that exposes Kodachrome film must have a color temperature of 3450° K for Type A or 3200° K for Type B. If not, the light source must be changed or regulated by the use of filters, control of voltage to the lamp or both.

Under some conditions, the color quality of the light is changed but slightly as it passes through the microscope, but other conditions may seriously affect this quality unless compensation is made. The causative factors are: (1) the lamp condenser or the substage condenser may not only affect the color quality of the light, because of the color of the glass, but may also introduce color variations when the substage condenser is focused at various levels; (2) fluorites used in microscope objectives vary in their degrees of yellowness; and (3) there may be color correction interactions of the optical components of the microscope. Thus specific

recommendations are impossible. These problems can be solved only by making and studying test transparencies with the various lens combinations of the apparatus in order to calibrate given set-ups.

DATA ON PHOTOMICROGRAPHY*

Type of Light Source	Color Temperature	Kodachrome Type and Filter Applications	Precautions
Carbon arc lamp with 6 or 8mm. amorphous core carbons	3430°K at 4½ amperes 3490°K at 5 amperes	Type A without filter; Type B with Eastman Color Compensating Filters	Results may be off color with some apparatus because of ultraviolet emission from cyanogen
Ribbon-filament, high-intensity tungsten lamps; or moderate-sized coil-filament lamps (except 3200°K)	Varies with lamp	Type A or Type B with proper Eastman Color Compensating Filters	It is necessary to guard against yellowish renditions that result from low color temperatures†
Mazda 3200°K lamps: T-20, clear bulb; A-25, frosted; possibly other large lamps in this line	3200°K	Type B without filter; Type A with Eastman CC4 Filter	Correct voltage should be maintained; large bulb or intense heat may necessitate special well-ventilated lamphouse‡
Mazda photoflood lamps	No. 1: 3490°K No. 2: 3450°K	Type A without filter; Type B with Eastman CC14 Filter‖	

*Complete ultraviolet elimination can be accomplished with Wratten Filter No. 2A. It is then necessary to rebalance with color compensating filters to prevent yellowishness because some ultraviolet is normally recorded as blue.

†Adjustment obtained by using color compensating filter, or by overloading lamp, using an adjustable autotransformer and an ammeter (preferably) or a voltmeter; this shortens lamp life, but not unduly if it is overloaded only during exposure time. An Eastman Color Temperature Meter is used to determine the filter and amperage required. The autotransformer and ammeter or voltmeter should be maintained in the current supply line so that any fluctuations can be detected and corrected.

‡If special housing is made for the lamp, it should trap all light not actually used on specimen and should incorporate condenser, diaphragm and water cell, which should also be well ventilated by forced draft if necessary.

‖As lamp burns, a black deposit collects on inside, decreasing intensity; if exposure compensation is not made for this, transparencies will be underexposed and reddish. New lamps should be used wherever possible.

LIGHT SOURCES

A light source for full-color photomicrography must be of the correct color temperature or satisfactory results cannot be obtained. While some light sources are suitable, others require color temperature adjustment. A simple means of determining the color temperature of a light source and making any necessary compensation is the Eastman Color Temperature Meter and its set of seven color compensating filters. The latter is composed of four bluish and three yellowish filters. With them, adequate color correction can be made for the types of light

sources commonly employed. Sources and compensation measures are given in the accompanying table.

Two light sources that are suitable for black-and-white photomicrography, but which should be avoided for full color work because they have discontinuous spectra, are the mercury arc lamp and the enclosed tungsten arc lamp (General Electric Photomicrographic Lamp). Nevertheless, the latter can be modified for use with Kodachrome, Type B, by utilizing a Wratten No. 2A and a Corning Didymium Glass Filter No. 512, 2 mm. thick, both placed between the water cell and the substage condenser.

SHUTTER

An absolute essential for full-color photomicrography is an accurate and reliable shutter providing exposures from time exposure through 1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, and 1/200 second exposures. It may be a separate unit placed between the lamp unit and the substage of the microscope; it may be part of the light lock between the bellows and the eye-piece, or it may be the camera shutter itself. The shutter should be operated with the self-timing mechanism or with a cable release to preclude jarring the set-up.

MICROSCOPE

Any microscope employed for professional work is suitable for full-color photomicrography, although it is desirable that it be equipped with a mechanical stage. Absolute cleanliness of the optical components is essential. Best results are obtained with apochromatic objectives and either compensating oculars or oculars designed for photomicrography. An Abbe condenser can be used, but an aplanatic or achromatic condenser is recommended.

CAMERA AND ACCESSORIES

Any camera that uses film of a size in which Kodachrome is supplied is suitable, although one having a long-extension bellows and a ground glass for focusing is preferred. The lens can be used, but should be removed if possible. A light lock must be made between the eyepiece and the front of the bellows in such a manner that adjusting and operating the camera will not jar the microscope. The camera must be rigidly supported so that the film is parallel with the stage of the microscope.

TECHNIC

It is imperative that the apparatus

Microscope, camera assembly and lamp unit arranged for photomicrography.

be properly arranged and adjusted. This will be discussed with the supposition that the reader has a working knowledge of the microscope.

Alinement of the Optical System.—Alinement is important to insure critical illumination on the specimen. The necessary steps, employing the Köhler method, are:

1. Open substage diaphragm to widest aperture. Place lamp sufficient distance from

microscope so enlarged image of filament is imposed on plane side of substage mirror, completely filling substage aperture when substage diaphragm is wide open.

2. Close substage diaphragm to smallest aperture and, by means of lamp condenser, bring image of lamp filament into sharp focus on leaves of diaphragm. If lamp bulb is frosted, a pencil point held against it may be used instead of the lamp filament for focusing.

3. Close lamp diaphragm to smallest aperture. Remove all lenses, including substage condenser, from microscope.

4. Look down microscope tube, preferably through pinhole eyepiece. Adjust mirror so image of small opening in closed lamp diaphragm is clearly seen through closed substage diaphragm. This alines lamp diaphragm, substage diaphragm and eyepiece.

5. Insert objective and ocular. Open substage diaphragm and lamp diaphragm to widest apertures.

6. Insert condenser of focal length suited to objective.

7. Place specimen slide on stage. Focus objective on specimen, protecting eye by interposing Wratten Neutral Density Filter between water cell and microscope.

8. Close lamp diaphragm to smallest aperture, and, while looking through eyepiece, focus on specimen sharp image of aperture of lamp diaphragm, by raising or lowering substage condenser. Note that when image of lamp diaphragm passes in and out of focus, color fringe around its edge changes from red to blue. Sharpest focus and least likelihood of color anomalies occur at point where change occurs.

9. Open lamp diaphragm until its image is slightly smaller than field of view seen through ocular of microscope. Center image in field of view. Slight adjustment of centering screws on substage may be necessary to obtain centricity. If microscope is not equipped with centering substage, image of lamp diaphragm can be centered by adjusting mirror.

10. Open lamp diaphragm only sufficiently to obtain uniform illumination of entire field.

11. Remove ocular and, with eye still protected from intense light, look down microscope tube. If preceding steps have been accurately followed, back lens of objective will be completely filled with light.

12. Close substage diaphragm, while looking at back lens of objective, until approximately two-thirds of diameter of back lens is illuminated.

13. Remove Wratten Neutral Density Filter when visual focusing is completed.

At this point, the required color-correction filters are placed in position (see accompanying table); always between the substage and the water cell, never between the water cell and the microscope lamp.

ADJUSTMENT OF CAMERA

Obviously, the camera must be held securely in position so that it is vibrationless and the planes of the film and microscope stage are parallel. Additional adjustment depends on the type of camera, whether (1) lensless or (2) with lens.

Camera Without Lens.—A long bellows extension camera is preferable, the amount of extension utilized depending upon several conditions. Of primary interest is image magnification on the film.

Doubling the bellows extension increases magnification twofold; thus, if ×50 magnification is obtained with a bellows extension of 10 inches, a 20-inch extension will provide ×100. If, however, a magnification of ×50 is obtained with a 10-inch bellows extension and a magnification of ×100 is desired to record greater detail, a higher power objective should be used instead of increasing the bellows extension, since the ability to image fine detail is a function of the objective.

When a microscope is focused visually, with the standard tube length of 160 mm., the objective operates at a specific distance from the specimen for which the objective is corrected. After the camera is brought into position, however, some readjustment is usually neces-

sary in order to produce a sharp image on the ground glass. Since the amount of adjustment required increases as the distance from eyepiece to ground glass decreases, very short ocular-film distances, usually encountered in miniature cameras when the camera lens is removed, give rise to certain aberrations that degrade the definition of the image. When the ocular-film distance is only from 3 to 5 inches, therefore, it is best to focus visually and refocus on the ground glass by means of a focusing ocular rather than by readjusting the objective. If such an ocular is not available, a sharp image on the ground glass can be obtained by changing slightly the length of the draw tube of the microscope, an adjustment not recommended or required for microscopy. If the draw tube is fixed, it will be necessary to use a focusing ocular or refocus the objective.

Final exact focusing is aided if a grid of fine pencil lines is marked in the center of the ground glass on its ground side. Over it, a circular cover glass is cemented with Canada balsam. Fine adjustment is made by observing the parallax between lines and image with a magnifying glass.

Camera with Lens.—The lens makes it possible to focus without serious readjustment of the objective, although a bright spot, the out-of-focus image of the back objective lens, is apt to be recorded in the center of the film.

After critical, visual focusing, the camera should be positioned over the microscope so that the Ramsden disk, that portion of the light beam of smallest diameter above the eyepiece, lies in the center of the camera lens. The diaphragm of the camera is opened wide, and should remain thus, and the lens focused for about 25 feet. (Because of individual differences in ocular perception, the distance setting may vary somewhat. It is, therefore, advisable to make test exposures at different settings to determine the exact distance at which maximum image sharpness is obtained. An alternative method is to focus on a ground glass. Many types of miniature cameras not fitted with ground glass focusing accessories are so designed as to permit the temporary insertion of a small piece of such glass in the film plane of the camera, with the ground side of the glass toward the lens. Focusing can be accomplished in this manner before the film is inserted.)

Finally, the space between the lens and the eyepiece is made light-tight with a flexible light lock of black paper or cloth.

Determination of Exposure by Making Test Exposures.—Since Kodachrome film is processed by a reversal method, a black-and-white reversal material with similar exposure characteristics can be used as a guide to correct exposure as described below.

Eastman Super Speed Direct Positive Paper has approximately the same speed as Kodachrome, Type B, when exposed to light of a color temperature of 3200° K, or one-half the speed of Kodachrome Film, Type A, when exposed to light of a color temperature of 3450° K. If the camera uses sheet film, the entire series of test exposures can be recorded on a single sheet of paper. The test is made as follows: The dark slide is removed entirely for the first (shortest) exposure, then pushed in one-quarter inch for each additional one. A series of shutter times successively doubled by employing the next slowest shutter speed are made (the shortest should be given in two steps) as 1/200, 1/200, 1/100, 1/50 second continued to include a one-second exposure. Exposures ranging from 1/200 to two seconds will then have been given the steps. The tests are repeated, using Kodachrome. The Kodachrome film is then sent to the processing station and the black-and-white reversal

material processed according to the instructions packaged with it. It should be noted that if the camera uses roll film, strips of paper must be cut and placed over the film aperture for separate test exposures, in which case, since exposures are not superimposed, it is not necessary to repeat the shortest one.

When the Kodachrome transparencies are returned, the transparencies and the results of the Super Speed Direct Positive Paper tests should be mounted side by side, with exposure times noted. This will provide a reference chart for determining proper Kodachrome exposure. To do this, test exposures of a specimen are made in black and white and, after processing, compared with the control series. In this manner, the correct exposure for Kodachrome can be estimated.

Determination of Exposure by Use of Exposure Meter.—Either a Weston or a General Electric exposure meter is capable of recording at the eyepiece of the microscope light intensities that require an exposure of about one second or less. If a set-up requires a longer exposure, an amplification system, as described by Gross and Johnson[1] and Hartley,[2] is necessary.

A photo-electric exposure meter, to be used in photomicrography, must be calibrated as follows, with a specimen of average density:

1. Compose and focus slide on ground glass, recording distance from ocular to film, if double extension bellows camera is used. Any change now made in bellows extension requires exposure compensation in proportion to square of distance from eyepiece to film. For example, if meter is calibrated for 10-inch bellows extension, indicated exposure must be increased fourfold for bellows extension of 20 inches, or decreased to one-quarter for extension of 5 inches. This only applies to miniature cameras when extension tubes are used and tube length is varied after calibration.

2. Remove specimen slide or adjust its position until clear section is under objective.

3. Rack up bellows, or remove camera, so that eyepiece of microscope is unobstructed.

4. Hold meter, adjusted for greatest sensitivity, so cell is one-eighth inch above eyepiece, and take reading of light. Move meter around while watching needle and record highest reading.

5. Return specimen slide to correct position and readjust camera over eyepiece.

6. Make series of test exposures on Kodachrome Film and record their sequence for future reference.

Comparison of the test Kodachrome with the specimen will show what exposure is correct. Any need for adjustment of the illumination may also be determined from this inspection. After the correct test Kodachrome has been selected, two facts are known: the light reading of the meter, and the correct exposure of an average specimen for that reading. This knowledge can be correlated so that the meter can be used subsequently for all set-ups. The method varies slightly for the two meters.

General Electric: Rotate dial so that exposure time that produced best test Kodachrome is alined with film-rating number (Kodachrome, Type A is 20; Type B is 10). (It may be necessary with General Electric or Weston to select an arbitrary film-rating number that will permit the use of a more satisfactory f/aperture. In any case, film setting and f/aperture are constant, have a definite bearing with respect to each other and, once selected, should not be changed.)

Next, refer to light reading recorded during preliminary test (calibration step 4) and note f/aperture alined on dial, with that figure. (This arbitrary f/aperture has with either type of meter no relation to the optics of the microscope, but is merely used as a constant in determining all future exposures.) Hav-

ing this constant, calculation of correct exposure time for any set-up is made by taking the light reading and turning the dial so that the arbitrary f/aperture is alined with it. The correct exposure time is then automatically alined with the film-rating number (20 or 10). (With either type of meter, if the specimen is very light, the exposure time should be reduced by a factor of one-quarter to one-half. If it is very dark, the exposure time should be increased by a factor of 1½ to 2. In rare instances of thick or very darkly stained specimens, it may be necessary to increase the exposure further.)

Weston: Rotate film-rating dial until film rating number (Kodachrome, Type A is 12; Type B is 6) appears in the window. Next, aline arrow with numeral indicating light reading taken at time of preliminary test (calibration step 4). Then refer on white dial to exposure time that was found to be correct for selected test Kodachrome. Alined above, it will be an f/aperture, which should be recorded. Future calculation of any exposure time is done by taking a reading of the incident light; setting the film-rating dial; alining the arrow with the light reading and reading the exposure time that is alined with the arbitrary f/aperture.

COMMON FAULTS AND THEIR REMEDIES

1. *Poor Definition.*—This is caused by: improper alinement of the illumination system; movement of the apparatus during exposure; improper focusing; faulty setting of the substage diaphragm; dirt on the lenses. Usually, the deficiency can be remedied by carefully following the technic described. If not, a different combination of objective and ocular may be indicated to achieve desired magnification and detail, in which event instructions supplied with the microscope should be consulted.

2. *Uneven Brightness.*—This is caused by incorrect alinement of the illumination system, which can be overcome by carefully following the directions for alinement. Rarely, the specimen may have been very unevenly stained.

3. *Bright Spot in the Center.*—This is caused by an out-of-focus image of the back objective lens, occurring when the camera lens is employed. Occasionally, uneven lighting or reflections within the apparatus cause this fault. The defect cannot readily be overcome unless the camera lens is removed. The spot can be enlarged and hence diffused, with some loss in definition, by changing the height of the camera lens above the ocular.

4. *Excessive Density.*—This is caused by insufficient exposure. The remedy is a longer exposure time. The lamp diaphragm or substage diaphragm should never be opened to a larger aperture, or the voltage on the lamp be increased to correct the condition.

5. *Insufficient Density.*—This is caused by excessive exposure. The remedy is a shorter exposure time. We should never close the lamp diaphragm or substage diaphragm to a smaller aperature, decrease voltage on the lamp, or interpose neutral density filters in optical axis to correct the condition.

6. *Reddish Cast.*—This is caused by a too low color temperature of the light. It is especially apparent with slight underexposure. It can be remedied by the use of a bluish color compensating filter or by raising the voltage on the lamp.

7. *Bluish Cast.*—This is caused by a too high color temperature of the light, which is especially apparent with slight underexposure. It can be remedied by using a yellowish color compensating filter or by lowering the voltage on the lamp.

8. *Muddy Brown or Greenish Cast.*—This is caused by some biologic stains, among them eosin as used in the hema-

toxylin-eosin combination, and fuchsin in Mallory's triple-stain. These are not well reproduced in Kodachrome transparency made with illumination of the correct color temperature, because of very narrow absorption bands of these stains, as well as their peculiar position in the spectrum. A most troublesome characteristic of the optical system of microscopes is that light, when it emerges from the eyepiece, often has a predominance of green. With a high green transmission, an attempt to solve the problem by changing the color temperature of illumination is useless. Both faults can be satisfactorily overcome by employing a magenta filter, since it transmits red and blue, but absorbs some green. A liquid filter is most suitable, so the water cell for the microscope lamp can be used as the container, although another cell placed between the lamp cell and the substage is preferable. The Kodak Magenta Compensating Liquid Filter can be used for this purpose or a suitable solution can be mixed from the formula below. The two solutions are not exactly equivalent. The Magenta Compensating Liquid Filter is most suited to correcting greenishness from optical phenomena. However, it yields a large measure of compensation for various stains so that the neodymium solution is needed only occasionally in exacting work.

No specific recommendations can be made in regard to concentration of filter solutions, because of the variation that will be experienced in the amount of correction needed, but the formula and suggestions regarding dilution of the solution that follow will prove useful.

MAGENTA LIQUID FILTER STOCK SOLUTION

Neodymium carbonate	6.126	gm.
Glacial acetic acid	7	cc.
Distilled water to make	100	cc.

12.5 cc. of stock solution diluted to 1 liter with distilled water is a good starting point when a water cell 32 mm. thick is used.

Obviously, specific technics cannot be recommended unless definite sensitized materials and photographic accessories are named. The data presented in this article should provide a satisfactory basis for routine photomicrography with Kodachrome Film.

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APPLICATION OF ACRYLICS TO OPERATIVE DENTISTRY

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SINCE the advent of plastics in dentistry, beginning with the introduction of vulcanite, the profession has become ever conscious of an ideal, a dream, of being able to restore to a high degree not only that beauty which was lost, but efficiency as well. Turn back the pages of history and listen to the words of praise for vulcanite, which enabled the dentist to make a positive fit, to replace the crude ivory appliances such as Washington wore with obvious discomfort.

Fate took a hand and led onward into the plastic field. With the Goodyear patent, men with vision, like the Hyatt brothers, were not to be denied. So celluloid came into being. Here was a new plastic which offered much, especially in esthetics. However, other qualities in the material, one of which was water absorption, made its use so limited that celluloid was finally discarded. With the view opened, however, to a possible future material which would combine usefulness and beauty, the profession has ever been ready to delve into the unknown of the plastics field, improving and adapting each in turn to our use. So came the sad parade of the phenolics, polystyrenes, vinyls, resovins, etc., each with qualities which seemed to be the answer to our dream. Then came the day of reckoning: They were not color fast, they warped or they disintegrated in the mouth. Others were too difficult to process to be practical or, when broken, did not lend themselves to repair. One by one, we have set them aside.

Then came a new organic plastic, acrylic:

> Acrylic and methacrylic resins are the resinous products obtained by the polymerization of the monomeric derivities of acrylic acid. This group includes acrylic and methacrylic acids, their esters, amides, salts, halides and nitriles. From a commercial standpoint esters are of most importance at the present time.

The methyl methacrylate that we use, which is one of the esters, is new as far as its application to dentistry is concerned. It is a material with qualities that we have long sought, a plastic that is clear, crystal clear, with the ability to absorb and transmit a high percentage of the surrounding light. Best of all, it is a plastic that will remain clear under all conditions. In color fastness, methyl methacrylate (acrylic resin) is second only to urea; therefore, any permanent dye that is not attacked by the monomer will remain stable. The previous color failures have not lain so much in the dyes, but rather in the tendency of the plastics to revert to their natural amber color.

Thanks to the chemical engineers and commercial research workers, we now have in the National Bureau of Standards factual data on the qualities of all plastics, so that we may leave the hit and miss group and begin our research and application of any plastic with a fair knowledge of its inherent qualities.

Read before the Section on Operative Dentistry at the Seventy-Eighth Annual Midwinter Meeting of the Chicago Dental Society, February 24, 1942.

So we have chosen methyl methacrylate with its color fastness and minimum of water absorption. The 0.5 per cent of water present is assumed to enter by osmosis and not by capillary attraction, and it is peculiar also in that practically all moisture is taken up within a comparatively short time after a dehydrated sample is placed in warm water (150°); that is, in a specimen fully polymerized at the correct time, heat and pressure. The water content is, to all practical purposes, constant from then on. This being true, in operative dentistry, we need never dehydrate, but rather place the processed restoration in water, where it will remain until we are ready to place it in the patient's mouth, at which time it is dried and cemented. The 0.5 per cent of water will not affect the cementing medium when placed against dentin with its upward of 15 per cent moisture content.

In toughness, the material does not appear at the top of the list, as we might wish, but is near enough to the top to give us the strength necessary for most of our uses. In heat resistance, the methyl methacrylate appears at the bottom of the list, which makes it possible to process it at the temperature of boiling water, and thus to establish resistance to that temperature. Since we do not expect the mouth to tolerate boiling water, we have no fear of dimensional changes during future use.

First with waxes, then natural resins, then cellulose products, E. Byron Kelly, who has been my teacher, collaborator and associate in this work, has sought to duplicate the human denture. It was at his invitation more than four years ago that I joined him in an attempt to color and process this new plastic to duplicate the shape and appearance of a natural denture. It is possible that other members of the profession have worked with this or similar materials, but none has exhibited the tenacity of purpose in carrying on in the face of opposition that has been shown by Dr. Kelly.

After about 3,000 test cases, we arrived at a point where we successfully carried a practical case through to completion. We had no signposts, no equipment, and a mountain of problems loomed ahead of us. First, we had to secure the right grade of methyl methacrylate and reduce it to a sufficiently fine state to be workable. We soon discovered that the finer the mesh of the material, the easier the handling as to both color and technic. We ball-milled it hour on hour. Then we had problems of color, compression, processing, finishing and cementing, each requiring many long hours for solution.

We had a vision of the possibilities and remembered the lectures of the Dean of Dentists, Charles Nelson Johnson, wherein he stated that we did not have the perfect dental filling or filling material. He outlined one by one the shortcomings in color, thermal conductivity, expansion and contraction, plus some of the qualities of disintegration of certain materials. He next outlined the characteristics that we should look for in the perfect filling. It must be the same color as the tooth in which it is to be placed. It should have the same degree of thermal conductivity. It should have the same wearing qualities, and should not disintegrate in the mouth fluids. These and other properties the methyl methacrylate seemed to possess to a degree justifying our continued experimentation. We realized that we could create the same color as that of surrounding tooth structure and that the material was a non-conductor both of heat and of electricity, and the wearing qualities seemed about equal to those of the natural teeth.

Finally, we made an incisal inlay the fit of which surpassed anything we had ever known, an inlay the color of which blended with the colors of the surrounding structures, making detection almost impossible. It was then we remembered

the words: "The perfection of art is to conceal art," and the desire to continue the work grew.

The color problem was a major one, but one day we arrived at a solution. Those who are starting at this time have at their disposal colored materials, from reliable sources. A fine quality material is necessary at all times, and a word of caution to those who are tempted to accept anything but the best is: Remember that "there is hardly anything in this world that some man cannot make a little worse and sell a little cheaper, and the people who consider price only are that man's lawful prey." We must remember that "the various acrylic resins range from soft, sticky, semiliquids to hard, tough, thermoplastic solids."[1]

We hoped for maximum results from this material, which has only half the tensile strength of pure gold, and we found that compression was necessary. To solve this problem, we went to the commercial molders, who told us what pressure was necessary for proper processing. We had then to find ways and means of arriving at that pressure and maintaining it. We have a veritable graveyard of flasks, tried and discarded one by one because they did not fulfill our purpose. We finally designed a small milled ring which has a "shut-off" to keep the material completely enclosed in the ring and under the proper pressure, a ring that will prevent the ingress of foreign materials.

The next problem had to do with heat and temperatures. Early in the work, we discovered that methyl methacrylate has a fluid state and undergoes shrinkage. The fluid state was reached, and shrinkage took place sometime during the rise in temperature. Continued experimentation taught us that the fluid state and subsequent polymerization developed at 168°F.; that is, between 160° and 168°, the mass reached its greatest fluidity. We learned that any additional pressure applied after the mass had reached 168°F. (75°C.) was of no help and only tended to strain the finished filling. Strain had a tendency to distort the filling, or cause cracking at a later date. We also learned that the temperature rise should not exceed two degrees per minute from the cool bath (100°F.) to polymerization temperature (168°). The flask encloses the plastic, which has been packed to 20 per cent excess, and allows us to place the required pressure on the material at the right degree of temperature, thus taking up the slack for the shrinkage and assuring a positive fit.

Equality of heat distribution within the flask is governed by centering the pattern. In this matter of even distribution, it is necessary in the restoration that all parts be the same temperature and thus polymerize simultaneously. Strains will result if one area is processed ahead of the whole unit.

There have been widespread rumors that certain people are allergic to methyl methacrylate, but, in my opinion, what is thought to be evidence of an allergy is, for the most part, nothing more nor less than burns from the unpolymerized liquid or the inhibitors that still have some free particles in the finished restoration. To make certain that these foreign substances are rendered inert, the temperature is raised beyond the 168° polymerizing point to 212° and held there for at least thirty minutes. The same result can be obtained in a lengthy processing of more than two hours at 168°. We believe that a tougher, better tempered product is obtained if the compress is left in the bath until the temperature has dropped to less than 175°F., and chilled or bench cooled before the flask is opened.

The finishing of the restoration is not difficult, especially when copper plated dies are used. The inlays can be carved and polished within the die before the copper is removed, and thus the chair

time be considerably reduced. With jackets, sandpaper disks cut too rapidly and we use large heatless stones for shaping, fine stones for the individual marking and flour of pumice for polishing, and add a high gloss with whiting and a rag wheel.

Cementation was and still is our greatest problem. The finest powdered cement is none too good. Fortunately, some of our reliable manufacturers are at present working on a new cement to be used only for acrylics. It is possible also that it will be but a very short time before we are cementing restorations with some form of the plastic itself, which will make the medium and the restoration all one piece. Meanwhile, the present color of cements will have a great influence on the finished product and it is well to try various colors with water or glycerin in case any doubt exists as to the shade required.

We have known since we began making dentures that methyl methacrylate cannot be processed against stone without losing some of its qualities, and, in the development of a workable technic, our first thought was to place tinfoil over stone models. We found that method successful as far as the surface was concerned, but unsatisfactory in crowns and inlays inasmuch as we had a resulting variation in thickness of the tinfoil. Our next step was to process the resin against a pure white zinc oxyphosphate cement, which did not disturb the color or fit, but had not the strength that we sought, was apt to break and sometimes broke within itself sufficiently to allow "wings" to be processed on the fillings. While this procedure was a step forward, it fell short of what we were seeking. Again we sought the commercial molder's opinion, and we found that they were processing between highly polished chromed steel plates. As we were not able to chrome modeling cómpound impressions, our method was copperplating.

The use of copper plated dies gives us theoretically perfect fitting inlays and the tinfoiled surrounding area does much for both color and density. For a long time, copperplating has been a known asset, but not widely used because of the time involved in the process. We set about to find a way of making this shorter and had a dry-cell battery electroplating machine made up with volt and milliampere meters, which give definite control. Thus, when we prepare an impression with the colloidal graphite and iron filings, we have an adequate copper surface in from one hour to one hour and a half. If the impression is perfect, we know the finished restoration, processed against a metal die and surrounded with tinfoil, will be a nearly perfect one.

We were naturally concerned with the wearing qualities and so we made two tests. The sandblast machine was directed against a piece of plateglass and a sheet of methyl methacrylate. The sand wore through the glass almost immediately, but left only a fine etching on the acrylic. In the second test, a gold crown was placed on a lathe, where, in revolving, it struck a piece of acrylic. The gold wore out almost immediately, and when the positions were reversed, the acrylic striking the gold, the wear on the gold was even greater. These tests among others demonstrated the much-to-be-desired rebound quality of the material.

In more than 1,000 practical cases over a period of three and a half years, we have found no appreciable wear and the feeling of softness similar to that of one's own teeth has greatly pleased the patients. Those whose porcelain restorations have been replaced with plastic comment on the pleasant change from the harsh shock of biting against porcelain.

Plastics have opened an immense new field in industry and will do the same in dentistry if we proceed carefully. We should have in the methyl methacrylate a material making it possible to render

greater service. We must remember that it is not fool-proof, nor is it a cure-all and we have no right to ask the impossible of it. Cavity preparation must be more definite and slightly more extensive than that for gold inlays, and we have no right to make extensive restorations for other than experimental purposes for several years. However, for incisal and gingival inlays in the front of the mouth, two surface inlays in bicuspids, jacket crowns and facings in gold crowns, I believe no finer material has been found, and that the color, appearance, feel and tissue tolerance are worth our every effort to develop this material to its maximum capacity.

SUMMARY

We are dealing with a comparatively new product. Although we have every reason to believe that it will always remain stable and impervious to mouth fluids, only the test of time can tell the whole story. No dental product can be said to be satisfactory until it has been tested in the mouth for several years. We believe in making haste slowly, starting with the simple restoration, gingival inlays, veneer crowns, occlusal inlays, etc., in which we feel certain the material has adequate strength to withstand mastication and mouth conditions.

The technic for handling is practical and within the ability of all, but it does take the care and skill required for any satisfactory gold or porcelain restoration.

And so chemistry has brought to our profession a new vision, another help in preserving the health and beauty of the mouths of mankind. If we use this new tool discreetly, it will bring the thrill that every artist must get with the creation of a masterpiece.

TECHNIC FOR PROCESSING ACRYLIC RESIN

There are, and will continue to be, many shortcuts offered in the processing of acrylic resins. The one outlined here has given the finest type of restoration that acrylics can offer.

IMPRESSIONS

Dietrich's compound has afforded the most satisfactory method of taking impressions. Its rubbery consistency allows the drawing over of undercuts without discrepancy. A slightly heavier copper band will be necessary since the material must be closely confined. Use of this material assures accurate reproductions in cavity preparations where acrylic or metal pins are to be used.

In gingival cavities, modeling compound, or inlay wax will be necessary and can be used without a copper backing.

Modeling compound is used for jacket crown impressions.

COPPER PLATING

Copper plated dies afford the most nearly perfect fitting and dense restorations, and in addition offer a metal die for finishing, thus aiding in the polishing of margins.

The copper band impression is attached to the cathode with wax in such a manner as to insure contact of the copper. The band is then surrounded with wax and the impression area washed with a supersaturated solution of Gold Dust, which dissolves all saliva or oil and leaves a clean surface, and dried with air. Next, the surface is painted carefully with enough colloidal graphite to barely cover the area and give a gray appearance to the impression. Every part of the impression must be covered, however. The impression is again dried and filled with control powder (iron filings), which is poured into the band and then poured back into the container. When filled with electrolite solution, dropped from a small eyedropper, the iron will form a chemical union and create a "copper flash" over the entire surface. The "sludge" is washed out and the cathode placed on the machine in the electrolite bath, after the current has been turned on. The "copper flash" will start the plating simultaneously over the entire surface, and if the machine can be controlled and kept at 0.4 volt, the milliampere meter will read between 100 and 200 and a sufficient copperplate will be laid down in from one-half to one and one-half hours.

When the gingival impressions are placed on the cathode with soft wax, it is necessary to have a small point of contact through the wax to the cathode so that this point will receive the coating of colloidal graphite and the iron filings. This will eliminate the necessity of backing the impression with copper.

After plating, the impressions are poured carefully in stone to avoid air bubbles and the impression compound is warmed and removed when the stone has set. In jacket crown dies, a small woodscrew may be placed in the plated impression and the stone poured around it. This can be turned out with a screwdriver when the crown is completed and will be a valuable aid in removing the stone, as well as a heat conductor in processing.

A fine carbon will remain on the die and this can be cleaned off with Bon Ami and a rubber cup or brush.

A much superior die can be made by a three-minute gold plating added to the copper. A copper wire is wrapped around the die in contact with the copper, the other end of the wire wrapped around the cathode pole and a piece of pure gold used as an anode. The gold plating solution can be obtained from a jewelers' supply house and will function properly when warmed in a bottle under very hot water before being poured into the small plating dish. This minute layer of gold will give an excellent surface and will peel away from the finished inlay without leaving any discoloration of any kind.

WAXING

For crowns, the wax pattern is carved on the master die and model and then transferred and luted to the copper die. For inlays, the wax is carved directly in the die in the desired shape. Either colored or white inlay wax can be used.

INVESTING

Inlay dies are invested in an upright position, with the investment carried high enough on the die to eliminate undercuts. The wax surface is covered with a 0.002 tinfoil and the upper half of the flask filled and the two halves are placed together.

Crowns may be invested either upright or flat. When the crown is invested upright, the tinfoil is placed on it, with the tinner's joint on the lingual aspect, just before the upper half is poured. Crowns invested flat are tinfoiled before investing and the foil is cut and pulled back on the labial surface with a sharp razor blade before investment of the upper half. The flat-pack flask may be opened after very slight warming, the wax carved away from what will be the incisal area and a second upper half run for use in packing.

After the investment has set, the flask is warmed to the point that it can be held in the hand comfortably, and opened and the warm wax picked out. The remaining wax particles are cleaned away with boiling water.

We should always make sure that the investment is covered with tinfoil at any point where it may be in contact with the acrylic, as otherwise discoloration will result.

PACKING

The desired colors are mixed in at least two separate jars. The powder is saturated by slowly adding the liquid. The mixture is stirred thoroughly and allowed to stand two or three minutes, or until it becomes thick and slightly stringy.

For inlays, the body color is packed first and then the incisal or occlusal color is placed on top to duplicate the normal blend of color. The incisal color is packed to excess to maintain compression and compensate for shrinkage. The flask should close only to within 2 mm. of its original position with hand pressure, and is now ready to process.

The crowns invested upright will leave an inversion to pack into, in which case the incisal color will be packed first and carried to its own fine blend in the mesial and distal portions before the body color is packed to a 20 per cent excess and the flask closed.

For crowns invested flat, the body color should be packed first, and the incisal color on top. If two upper halves are used, the body color is given a two to three minute biscuit bake before the incisal color is added and the first upper half placed on for processing. The acrylic is covered with a fine tinfoil, or with cellophane, and the flask is closed to within 2 mm.

Caution. In handling the acrylic, stain-

less steel or agate instruments should always be used, and if use of the fingers is necessary in blending, they should be protected with a piece of wet cellophane. The unprocessed acrylic not only will burn the skin, but also will pick up any foreign color or dirt that it touches.

PROCESSING

The flask in its press is immersed in the liquid bath at about 100° F. We prefer glycerin because it allows a better control of temperature. From the starting point, the temperature is increased at the rate of 2 degrees a minute, thirty minutes being required to reach 168° F. At this time, the flask is completely closed, and it is not interfered with by mechanical or spring pressure in any way during the rest of the processing. The temperature may now be raised to 212° F., and held there for one-half hour, to insure destruction of any of the inhibitors that are used in every liquid. The same result would be obtained by holding the temperature at 168° F. for three hours or more.

If time permits, the flask remains in the glycerin until the temperature drops below 175° F., and then is immersed in cool water and chilled. The flask is then opened, the prosthesis removed and the tinfoil peeled away from the outside.

FINISHING

The stone is removed from the die and the margins of the prosthesis are finished with stones before the copper is peeled out or away. The use of gold plated dies will completely eliminate any discoloration and will be found to be well worth the additional three minutes' plating time. In addition to the stones, an incorporated pumice wheel, and a rag or felt wheel and whiting will complete the finishing and leave a high glaze, to which mouth tissues take kindly.

CEMENTATION

Cementation is at present our greatest problem. The finest quality cement available should be used and a complementary color chosen. Various colors can be tried with water or glycerin, to find the correct shade, as the translucent acrylic will readily reflect color.

The inlay is allowed to remain in warm water (150° F.) for at least five hours before seating. This will give it time to absorb moisture before rather than after setting. When ready to cement, it is merely dried off with an air blast before being placed in the cavity.

COMMENT

The formula for the copperplating solution is as follows: distilled water, 700 cc.; copper sulfate, 105 gm.; sulfuric acid, 64.4 cc.; ethyl alcohol, 2.8 cc. The investment is made up of 60 per cent quick-setting laboratory plaster, 40 per cent white stone by bulk.

1. Plastics catalog.

25 East Washington Street.

GRENZ RAYS IN THEIR APPLICATION TO PERIODONTAL DISEASE

RALPH HOWARD BRODSKY,* D.M.D., New York, N. Y.

PERIODONTAL disease has a history dating back to the beginning of *Homo sapiens.* There is ample evidence from ancient as well as transitional skulls that man has always been afflicted with this disease. It has been given many names, and has had assigned to it multiple causes. It can be classed with such almost universal diseases as the common cold, dental caries and the loss of hair, for which, as yet, no adequate explanation as to etiology or mechanics has been brought forward.

It is true that, from time to time, some light has been cast on these diseases, illuminating perhaps a facet here and there, and undoubtedly offering some benefit, but each of these diseases as an entity still has many dark spots.

It is my purpose to describe briefly a new therapy for these various gingival lesions which has made possible beneficial results in cases that did not respond to the usual therapy. I do not offer it as a cure-all, but rather as a very valuable method to be used in conjunction with other known methods for the elimination of these conditions. I shall not endeavor to discuss the many known factors in the history of periodontal disease. These have been adequately treated elsewhere. The lay term "pyorrhea" has been extensively used, but the term "periodontoclasia" or "parodontosis," I believe, has greater scientific validity.

Prepared for the Section on Periodontia of the American Dental Association, 1942.

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Periodontoclasia is found only in mouths where teeth are present, commencing with the child and concluding with the senile adult. It is more apt to appear during the middle thirties and, unless it is checked, it usually continues to involve more and more of the gingivae and the supporting bony structures of the teeth. I dare say that more teeth have been lost from this disease than from any other.

Through the advent of roentgenography, we have been enabled to study the ravages of the different stages of the disease. One mouth may manifest a mild localized marginal involvement, while the next may present evidence of a generalized alveolar resorption, either mild or extensive. Then the pockets may form horizontally or vertically. Sometimes, the pockets spiral around the tooth. (Fig. 1.)

Clinically, there may be evidence of gingival disturbances such as anemia or, more commonly, hyperemia of the mucous membranes, and frequently hypertrophic and hemorrhagic involvement. On digital compression, we may be able to express some of the suppurative material from the pockets, while, at other times, we may find such a profusion of it that the teeth are literally bathed in pus. In addition to the gingival changes, we may recognize the migration of the teeth, sometimes in a wandering manner, or we may observe an actual attempt at exfoliation of a tooth.

These are the everyday varieties seen by the average practitioner. In the case of those who devote more time to the

treatment of periodontal diseases, there must be included many more types, such as pregnancy gingivitis, vicarious menstrual gingivitis and the other endocrine types, the types due to ingestion of specific drugs, various systemic types such as diabetes and leukemia, malnutrition types, types due to specific bacterial or filterable virus infections and galvanic types.

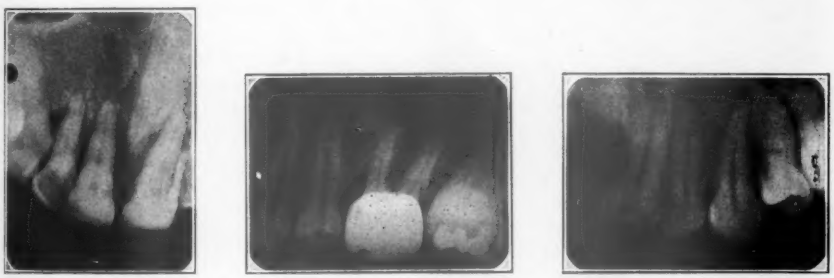
THERAPY

Now, having recognized the type and degree of extension of the periodontal disease, how should we treat it? There should be a basic routine for all types, which should include oral hygiene, checking the occlusion, correcting faulty restorations, removing disturbing factors such as impacted teeth or cysts, and balancing or correcting the diet. Needless to say, specific diseases or drug addiction or any extraneous conditions must be dealt with by either the dentist or the physician, or often by the synchronized action of both.

Having resorted to these measures, we still find a certain percentage of patients who continue to manifest forms of periodontoclasia because they require more specific gingival therapy. In the past, we have had available the following general methods which have proved to be of some value: subgingival curettage, massage, the use of chemicals or drugs, electrocautery, surgical removal by means of gum resection or gum formation of flaps with curettage of the subgingival and exposed bony surfaces of the pockets.

I have seen a number of cases of gum resection with resultant extensive exposure of the sensitive cervices of the teeth and have observed a recurrence of the suppurative processes. Likewise, many patients have been subjected to any or all of the above-mentioned methods of therapy and still show periodontal lesions.

About seven years ago, I experimented with rays that were not then known to dental therapy, the grenz rays. These rays were discovered by Gustave Bucky. The wave length lies about halfway between the x-rays and the ultraviolet rays. They had been used in Europe quite extensively for certain conditions, particularly dermatologic and endocrine, and had been conclusively demonstrated to be perfectly safe in doses much greater than those that I planned to use. For mucous membrane therapy, the x-rays are too hard and too penetrative, while the ultraviolet rays are entirely too shallow. For superficial radiation therapy, the required depth is



A B C

Fig. 1.—A, horizontal pocket formation. B, vertical pocket formation. C, spiral pocket formation involving cuspid.

limited to a few centimeters; hence, the radiation should not penetrate deeper. It is generally accepted that the absorbed energy and not the wave length or radiation quality is responsible for the biologic or therapeutic effect. The grenz rays will penetrate to a depth of 3 mm. of mucous membrane, and can be so regulated that approximately 90 per cent of the rays can be absorbed where desired.

Fig. 2.—Grenz ray apparatus.

In tuberculous ulcer of the mouth, that painful, resistant ulcer for which we had no adequate therapy, the usual methods of surgery, cauterization or ultraviolet irradiation were of very little or no value, in most of the cases, and because of an inability to eat, the patient usually dies.

Grenz ray irradiation of these lesions almost miraculously resulted in elimination of the pain, in most cases within from twenty-four to forty-eight hours after the first treatment, and if the general tuberculous process had not become too advanced, we invariably effected healing of the ulcers. This led me to believe that the grenz rays might have a beneficial result in the therapy of periodontoclasia. Hence, I selected first a group of fifty cases so very far advanced that the average dentist would not even make an effort to save the teeth. Experimentation with dosages finally led to the point where almost all of these cases were rendered pus-free and, in many cases, the teeth became perceptibly firmer.

Next, I treated a series of patients for advanced periodontoclasia experimentally only by irradiating the mouths with the grenz rays, not resorting to scaling, prophylaxis, etc., and I demonstrated to members of my staff, who had closely observed the cases throughout, that the grenz radiation alone exerted a definite curative effect. Subsequently, much larger groups were treated with the combined method of grenz radiation and subgingival curettage and massage, with consistently good results.

The grenz-ray apparatus is one simulating an x-ray machine. (Fig. 2.) Pyrex glass (boilable) applicators of different sizes are attached to the tube and placed in contact with the gingivae. The average treatment requires from a few seconds to a few minutes, the time depending on the type and the depth of the lesions as well as the type of apparatus employed. The average intern, after observing a demonstration, is qualified to use it. It is painless and extremely simple in application, and, by virtue of the softness of the rays, is perfectly safe for both patient and operator. Until one uses it and observes the tissue changes which it ef-

fects, one is apt to view it with skepticism. However, it is not presented as a cure-all, but rather as a means, in addition to other available ones, which will reduce the time necessary for good results, and, in some cases, it will make possible good results where they otherwise might not have been attainable.

In my office, I have been enabled to study many cases in which routine therapies for periodontoclasia employed by various periodontists had been unsuccessful, and which responded promptly to grenz-radiation therapy. At the present time, I am just concluding the treatment of two cases that are illustrative.

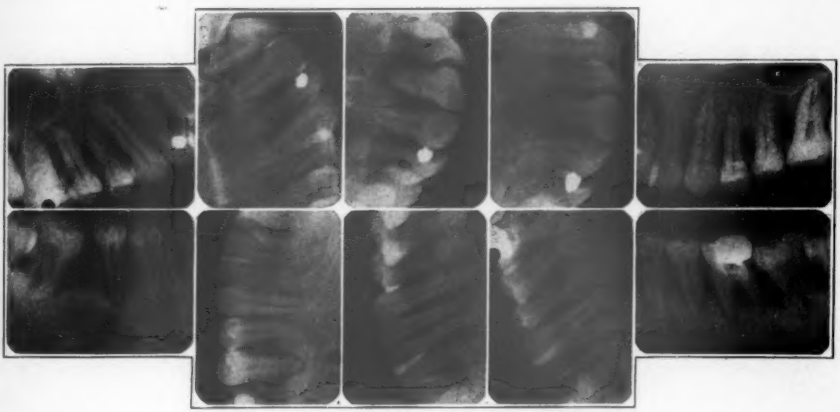


Fig. 3.—Intra-oral roentgenograms showing extensive bony loss of the supporting structures. In spite of this advanced condition, the teeth have become firm in their sockets, and there is no longer any evidence of a suppurative process.

REPORT OF CASES

CASE 1.—Mrs. P., aged 25, and well developed, was advised by several dentists to have most of her teeth removed. (Fig. 3.) She was unable to eat solid foods because of discomfort in occluding most of the teeth. On the advice of her physician, the patient had gone to one of the large hospital consultation services, primarily to rule out any possible systemic factor in the extensive generalized suppurative periodontoclasia. The blood calcium and sugar were found to be within normal limits and no systemic condition could be demonstrated that might have contributed to the dental status. The mouth was carefully examined by a colleague who is recognized for his diagnostic ability and good judgment. His report follows:

"Virtually all the teeth are loosened, some to an extreme degree. The degree of loosening is obviously proportional to the loss of alveolar bone and to the depth of the gingival crevices. In other words, this is a case of what is generally termed horizontal pyorrhea, a horizontal, insidious destructive process due to both local and systemic conditions. The local conditions are: (1) inequality of the bite, having a traumatic effect on the supporting tissues of the teeth, and (2) subgingival deposits of tartar (so-called serumal calculus). The prognosis is poor because of the degree of bone destruction. Probably all of the teeth with the exception of the lower anterior ones will have to be removed in the near future. Those remaining should be treated periodically by ordinary hygienic procedures."

The rest of the consultation report was essentially negative. Prior to the removal of the teeth, the patient's physician asked that I be consulted concerning grenz radiation. Careful examination revealed a dental condition for which treatment did not promise much. I suggested that although the

result would be highly speculative, I was willing to give the patient a series of grenz irradiations, since I felt that there was a possible chance of success.

Several months ago, she received the first treatment. This was followed by two treatments weekly, alternate irradiation and subgingival medication and massage, with subgingival scaling or curettage at each visit. The diet was fortified with vitamin concentrates and otherwise balanced. The occlusion was adjusted. After eight weeks, the treatments were spaced at one each week and then one every two weeks. With the exception of the upper right central incisor, which, from the time of the patient's first visit, retained so little support that it might easily have been removed, all of the teeth in the mouth have become markedly firmer in the sockets. They are pus-free, and the patient, for the first time in a very long time, is no longer conscious of her mouth.

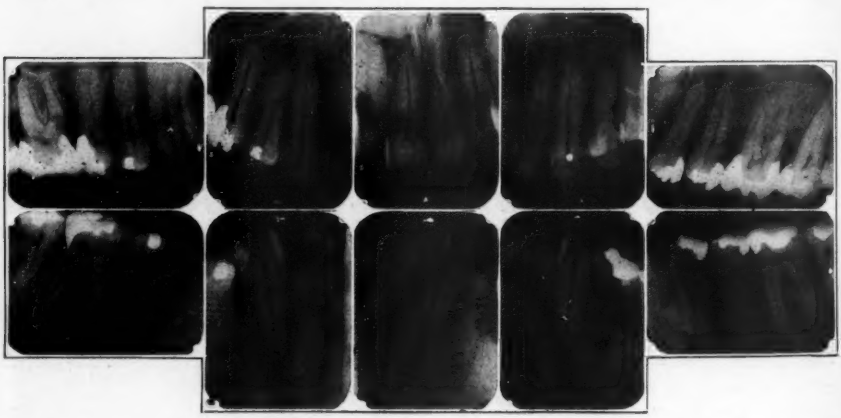


Fig. 4.—Intra-oral roentgenograms showing deep subgingival pocket formation. After a short series of treatments by grenz radiation, the patient was rendered pus-free.

CASE 2.—Mr. T., aged 42, manifested a generalized suppurative periodontoclasia with some deep pocket formation. (Fig. 4.) He was quite sensitive to his oral condition, almost to the point of developing a psychosis. He consulted various dentists in and adjacent to his city and received the usual therapy, including gingival resection (gingivectomy) involving half of the mouth. When he subsequently consulted me, a few months ago, there was evidence of subgingival suppuration in all four quadrants of the mouth. Grenz radiation therapy was immediately instituted and it was not long before he was rendered pus-free.

These are two of many similar cases.

COMMENT

The best cure for any disease is prevention. In periodontoclasia, the millennium will probably never come, for there are too many variables in the disease. Progress has been made, and undoubtedly will continue, to preclude many of the forms or types of this disease. However, the disease is widely prevalent today throughout most of the civilized communities of the world. In the large centers where there are available dentists who are qualified to treat periodontal disease, many patients can be helped. A certain percentage, in spite of this, are not rendered free of the disease. A large percentage of the population probably receive no periodontal attention, for many reasons, such as the time-consuming character of the usual form of treatment, with its attendant expenditures; or the inability of the average dentist to adequately treat the disease.

In the treatment of pneumonia, sulf-

anilamide and its derivatives have proved to be very definitely useful, in conjunction with other known means, in reducing the mortality from this disease. The grenz rays, similarly, when used in the treatment of periodontal disease, in addition to correction of the diet, occlusal and operative adjustment, scaling, subgingival curettage, subgingival medication, oral hygiene and correction of endocrine or systemic disturbances, any or all of these, have been found to be definitely beneficial.

CONCLUSION

In clinical experience, the grenz rays have proved to be a valuable addition to the armamentarium of the periodontist. They are extremely simple in application, requiring no more skill than the use of a dental x-ray apparatus. Each treatment requires not more than a few minutes. Years of clinical and experimental use has demonstrated them to be perfectly safe within limits far beyond their advocated usage. They are entirely painless in application. When employed in conjunction with other known therapy for periodontal disease, they are found to be definitely useful, making possible beneficial results in many cases which would not respond to the usual methods of treatment.

14 East Eighty-First Street.

PREPARATION AND CHARACTERISTICS OF ELASTIC DENTAL IMPRESSION COMPOUNDS WITH AN ALGINATE BASE

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INTRODUCTION

THIS report deals with elastic impression compounds. It describes the use of a new material which not only promises to be a satisfactory substitute for the agar type of compounds (no longer available for dental use), but also bids fair to displace it because of a number of inherent superior qualities not found in other types of compounds. The development of a new impression and duplicating compound is described in this report.

The hydrocolloidal suspensions of agar, which were patented nearly twenty years ago, were recognized as one of the most satisfactory materials available for use where undercuts and complicated contours were to be reproduced accurately in a model.

The restrictions on the use of agar have brought forth numerous substitutes made of resin, wax, rubber and agar-like materials, some of which can be used with a fair degree of satisfaction. Some give roughened surfaces. Others deteriorate with age and cannot therefore be stored for any length of time. In elasticity, some so-called elastic impression compounds are decidedly inferior. While such materials can be withdrawn from undercuts and similar shapes, the material does not snap back to the exact contour of the thing being molded.

IMPRESSION COMPOUNDS EMPLOYING SOLUBLE ALGINATES

Among the more promising of these substitutes have been those employing a

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soluble alginate (a product obtained from kelp) as the principal ingredient to supply the necessary elasticity and perfection of surface detail. The materials now on the market are supplied as a powder, which, on the addition of water, will react, within from five to ten minutes passing through the following stages: plastic to elastic to a fairly rigid state. Except for shrinkage, caused by the gradual loss of water by evaporation, they appear to be suitable for most dental impression work.

The basic ingredients of these materials are a soluble alginate (sodium, potassium or ammonium alginate), a calcium compound having a low solubility (anhydrous calcium sulfate), inert filler materials (calcium carbonate, magnesium oxide, calcium sulfate, zinc oxide, etc.) and a small amount of a soluble phosphate, usually trisodium or tripotassium phosphate.

The chemistry involved in the formation of the elastic material is as follows: A soluble alginate dissolved in water will form a soft soluble gel, which will mold readily to the shape of anything against which it is pressed. If, now, this soft soluble gel is converted into an insoluble alginate such as calcium, zinc, or iron alginate, the gel will have a certain amount of elasticity and such other physical properties that it may be used to take impressions. One difficulty encountered in carrying out this procedure is to devise some means of permitting the soluble gel to form and then to convert it into an insoluble gel *in situ*. This is accomplished by the addition of calcium salts, which are only slightly soluble, but sufficiently so to furnish the necessary calcium ions to convert the soluble gel into an insoluble alginate. There is the further problem even with insoluble salts of calcium, which may be used, in that they furnish calcium ions too quickly upon being placed in water, with a resultant premature setting of the gel. This is overcome by the addition of a small amount of a soluble salt (trisodium phosphate), which forms a more insoluble compound of calcium than calcium alginate. In this manner, the calcium ions which are formed during the mixing period are effectively removed, and thus premature setting of the gel is prevented. After the small amount of trisodium phosphate added is removed as an insoluble calcium phosphate, any further calcium ions which form may then react with the soluble alginate to form the insoluble elastic gel. The setting time is controlled in the main by the solubility of the calcium salt employed and the quantity of soluble phosphate added. Other factors, however, such as particle

PHYSICAL PROPERTIES OF IMPRESSION MATERIALS PREPARED FROM AGAR, SOLUBLE COMPOUNDS OF ALGINIC ACID AND INSOLUBLE COMPOUNDS OF ALGINIC ACID

Lot	Breaking Load Gm. per Cm.²	Strain Per Cent	Set Per Cent
Agar Type			
A	2,100	18.6	2.4
B	2,800	17.0	0.6
C	>3,500	13.9	0.8
Soluble Alginate Type			
A	2,400	19.0	5.9
B	>3,500	14.1	3.8
C	2,000	14.5	4.5
Insoluble Alginate Type			
A	>3,500	13.6	3.8
B	>3,500	12.9	3.4
Specification Requirements*			
	2,000 or more	4 to 20	0 to 3

*The values given here represent limits set by Federal Specification U-I-496 for Hydrocolloidal Impression Materials.

size, amount of filler, quantity and temperature of the water added, have their influence on the setting time. This is particularly true for the temperature of the water.

Although these materials do give excellent results, difficulties have been encountered in their manufacture and use, one of which has been their tendency to absorb moisture during storage. This results in premature removal of the soluble phosphate, and permits formation of an insoluble gel before mixing. Such a material will not cohere and a homogeneous gel mass is not produced. It is not satisfactory for the taking of impressions. In a previous publication,[1] a method of rejuvenating such materials by the addition of a small quantity of trisodium phosphate to the water at the time of mixing was described. At least one manufacturer now uses this procedure, furnishing a small quantity of phosphate in tablet form, which is dissolved in the water used to prepare the impression material.

As in the case of the agar gels, the alginate gels will shrink if they are exposed to conditions under which they may lose water. Furthermore, some of the impression compounds prepared from the alginates give poor surfaces to the stone models poured into them. The surface may be soft or even etched in appearance, as a result, it is believed, of extraction of water from the gel surface by the setting stone or by a reaction between some residual soluble alginate and the stone. In such cases, a hardening solution is supplied in which the impression is immersed prior to the pouring of the stone model. While use of this solution does prevent the formation of poor stone surfaces, it does not in all cases prevent a certain amount of shrinkage through loss of water unless the model is poured promptly. For this reason, it is always advisable to pour the stone model as soon as possible after the taking of the impression. Wrapping the impression in a damp cloth or immersion in water is not a guarantee against shrinkage.

A comparison of the physical properties of three trade brands of these materials with the properties of the agar compounds as shown in the accompanying table reveals that, with the exception of the value for permanent set under heavy loads, they should be satisfactory for taking impressions if the model is poured as soon as possible after the impression is made. If care is taken in pouring the model, there need be no excessive load applied and consequently no danger of distortion from permanent set.

DEVELOPMENT OF NEW IMPRESSION COMPOUNDS EMPLOYING INSOLUBLE ALGINATES

A new alginate impression compound developed at the National Bureau of Standards has certain definite advantages not possessed by those now containing soluble salts of alginic acid. In our previous work on the formation of insoluble films of calcium alginate[2] as a substitute material for tinfoil, it was observed that these insoluble films could be readily removed from plaster surfaces by immersion in a solution of trisodium phosphate. By this process, the insoluble alginate is converted to a soluble form. It was thought that if an insoluble alginate or alginic acid could be used in compounding the impression material and the insoluble alginate be converted into a soluble gel at the time of mixing, the tendency to premature reactions during storage would be lessened and the qualities desirable in an impression material be enhanced. It was found that calcium alginate or alginic acid could be used or a soluble salt of alginic acid treated in such a manner as to form an insoluble coating of alginic acid or calcium alginate. A small quantity of a soluble salt must be added which is capable of forming compounds of calcium more insoluble than calcium alginate or of converting the insoluble alginic

acid into a soluble form. Soluble phosphates (trisodium or tripotassium, etc.) were found to be satisfactory for this purpose.

In these experiments, it was observed that alginates treated in such a manner as to coat each individual particle with a layer of alginic acid gave the best results. This preliminary treatment of the soluble alginate, which is not a difficult process, may be carried out as follows: Powdered sodium or potassium alginate which will pass through a No. 100 sieve is placed in diluted hydrochloric acid (1 part hydrochloric acid, specific gravity 1.19, to 1 part water) and allowed to remain for approximately one hour, after which the acid is removed by decantation. The treated powder is then thoroughly washed with alcohol (95 per cent ethyl alcohol) and air dried. The entire procedure for treating a pound of alginate should require not more than two hours. This quantity of material is sufficient for about 100 impressions. Powdered alginate which will dissolve to form a 2 to 3 per cent solution in water is satisfactory. In the experimental work here reported, we have used Kelmar, a product manufactured by The Kelco Products Company, 21 Nassau Street, New York, N. Y.

This acid-treated alginate, when mixed with a slightly soluble calcium compound, soluble phosphates, magnesium oxide and water, reacts to form an insoluble elastic material. It has been observed, however, that the material prepared in this manner contains many small lumps and is difficult to mix thoroughly. This difficulty is entirely overcome by the addition of a small amount of a powdered wax. The wax also decreases the tendency of the powder to absorb moisture prematurely and improves the surface of the finished impression.

The impression powder is prepared in any desired quantity by mixing in the following ratios: 4 gm. of this treated alginate with 5 gm. of calcium sulfate ($CaSO_4.2H_2O$), 2 gm. of magnesium oxide (MgO), 0.5 gm. of borax ($Na_2B_4O_7.10H_2O$), 3 gm. of trisodium phosphate ($Na_3PO_4.12H_2O$) and 5 gm. of powdered wax. (We have found powdered Acrawax C, manufactured by The Glyco Products Co., Inc., 230 King St., Brooklyn, N. Y., satisfactory.) The basic amount specified is sufficient material, when mixed with 40-60 ml. of water, to make one full dental impression. All of the ingredients, with the exception of the alginate and wax, can be obtained from most chemical companies. They should be purchased in the powdered form and of U.S.P. grade. If desired, flavors and organic dyes employed in coloring foodstuffs may be added to impart flavor and color to the compound. The powder should pass through a No. 100 sieve. No particular mixing equipment is necessary. A rubber mixing bowl used for mixing plaster is ideal. The mixed powder should be poured into the water (temperature 65-75°F) and thoroughly mixed for one to one and a half minutes. The paste formed in this manner is placed in a dental tray (a perforated tray is not essential). The material should be placed in the mouth within three minutes after mixing is started. An insoluble elastic gel will form after three or four minutes in the mouth, after which it can be removed in the usual manner.

The impression will have a smooth glossy surface and will reproduce the finest detail of the oral cavity. The impression is washed in cold water and immersed in a solution (prepared by dissolving 10-20 gm. of manganese sulfate [$MnSO_4.2H_2O$] in each 100 ml. of water) for ten to fifteen minutes, after which the excess solution is removed from the surface. The impression is then ready for the stone or plaster. This should be poured as soon as possible for the best results. The manganese sulfate solution should be retained as it may be used over

and over. Water may be added to replace that lost by evaporation. This solution must be used if smooth, hard stone surfaces are desired. The surface of stone poured against the untreated alginate is soft.

It will be observed that this powder, on being mixed with water, differs from other alginate impression compounds now on the market in that it does not form a thick paste, but forms a creamy mixture of about the consistency of a thin oil. In this form, the material is suited for duplicating purposes in much the same manner that the diluted agar compounds are. The following procedure is recommended for making duplicate models. The surface of the model to be reproduced is coated with a thin layer of vaseline to prevent the impression compound from adhering to the surface. The model is mounted in an ordinary duplicating flask. The impression material is poured over the model and vibrated to assist in the removal of trapped air. The impression material for duplicating purposes should be prepared with cold water (approximately 50-60°F) as this delays the formation of the gel, provides a more fluid mix and gives the operator more time for carrying out the necessary operations. The setting time is delayed approximately ten to fifteen minutes when water at a temperature of 50°F. is used. After removal of the model, the impression material is placed in the manganese sulfate solution for from ten to fifteen minutes, at the end of which time it is removed and the surface is dried. It is then ready for pouring of the stone or plaster. Excellent duplicate models can be prepared by following this procedure.

Data on the physical properties of the set elastic material are given in the table. A comparison of these data with those given on agar impression compounds shows that this material compares favorably in strength, permanent set and ability to withstand strain under compression. Other advantages possessed by this new compound are: (1) low cost per unit; (2) adherence to smooth metal surfaces; (3) suitability for making duplicate models in the customary manner; (4) setting characteristics such that ample time is available for coating tooth surfaces prior to actual insertion of the bulk of the material to assist in the elimination of air bells, and (5) sufficient fluidity prior to the time of gelation to reduce the chances of trapping air; thus providing a more nearly homogeneous mass in the set impression.

Patent rights have been assigned to the Secretary of the United States Department of Commerce.

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FEDERAL AID IN PUBLIC HEALTH DENTISTRY

WALTER J. PELTON,* B.S., D.D.S., M.S.P.H., Washington, D. C.

RECENTLY, Paul V. McNutt, director of Defense Health and Welfare, said ". . . it would seem that health departments have too limited conception of their possible functions and activities."[1] He pointed out in the same address that many health departments continue to operate for the most part within the restricted sphere of duties bequeathed to them by tradition—routine inspection and advice on a broad, impersonal basis. Meanwhile, the community may be sorely in need of additional help that the health department is peculiarly equipped to give. Hospital facilities and medical care may be grossly inadequate. Faulty industrial hygiene may be robbing workers of vitality and the country of needed goods.

Concerning dental programs specifically, it is now evident that the draft rejections have revised many health administrators' conception of the issues involved. In states where the emphasis was on education or inspection, thinking administrators now realize that the former programs did not solve the real problem —dental care. With the loss of dental practitioners to the armed services, the lack of services to all population groups is bound to become acute before the year is out. Already, some rural sections are badly in need of health service beyond the scope formerly thought to be within the province of health departments. The expansion of industry and associated housing projects have already complicated the problem of health facilities in certain rural areas.

Perhaps the cost of dental care has kept many states from developing service programs. On the other hand, curtailed activity in certain other health fields has freed funds that could well be used for dental service programs.

In this connection, Mr. McNutt said,

> Failure to be more aggressive and to expand activities in conformity to needs cannot in many instances be attributed to lack of funds. Since passage of the Social Security Act of 1935, the Federal Government has been making substantial grants to the states in order to help them finance their health programs. As a result, we now have a framework of organization which permits a very wide latitude of operation. Yet the states for one reason or another fail to develop essential service while unexpended balances of funds accumulate on their books.[1]

The amount of money budgeted for dental programs at the state level in the United States for the fiscal year of 1941 was only 0.6 per cent of the $109,352,919.33 budgeted from all sources for cooperative health work.[2] From the summaries of the 1942 budgets, it appears that dentistry budgeted 0.7 per cent of the $118,843,415.21 budgeted for health work from all sources. This is not a very impressive percentage as compared with the amounts proposed for expenditures in other health fields.

What then is needed to materially expand dental programs? The answer generally given is "money." Yet this is not the whole truth, as indicated previously. There are certain fundamentals even closer to the heart of the matter. If dental health programs have not been granted funds to operate according to

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Read before the Oral Hygiene group of the American Public Health Association at the Seventy-First Annual Meeting, St. Louis, Mo., October 28, 1942.

modern standards, the fault lies partly with the program itself. A probability is that the program director has not asked for money, or that he has not been aggressive enough in pressing his claim; or perhaps the programs do not definitely meet the real needs of the community.

That the states have allowed unexpended balances to accumulate is difficult to understand, especially since the Committee on Health Programs of the State and Territorial Health Officers' Conference has recommended "that state health departments place more emphasis on programs for dental care and industrial hygiene."[3] These words bluntly express the thought contained in "An Official Declaration of Attitude of the American Public Health Association on Desirable Minimum Functions and Suitable Organization of Health Activities."[4]

The dental profession itself has endorsed service programs in the following terms:

> Organized dentistry in this country has the definite duty of expanding its usefulness to the public by diminishing the effects of dental diseases upon the population. This can best be done by effective organization of the dental facilities of the state and community through the cooperation of governmental dental health officers and organized dentistry....[5]

Every official agency involved in the matter has given its approval of dental care programs. The public needs have been shown and national dependence on good health is obvious, yet we lack the leadership to develop our programs to the extent that usable funds are exhausted.

The question arises: What are the federal sources of monetary backing for health programs? Dental programs as an activity of state health departments have benefited by several titles of the Social Security Act of 1935. The law is divided into eleven divisions called titles and the two main titles of the act that affect dentistry to any substantial degree are Title V and Title VI. Title V is in several parts. Part I (Section 501) is administered by the U. S. Children's Bureau and is "for the purpose of enabling each state to extend and improve, as far as practicable under the conditions in such state, services for promoting the health of mothers and children, especially in rural areas and in areas suffering from severe economic distress. . . ."[6] This is the authority for the activities under Maternal and Child Health programs.

Part II (Section 511) of Title V is also administered by the U. S. Children's Bureau and is "for the purpose of enabling each state to extend and improve (especially in rural areas and in areas suffering from severe economic distress), as far as practicable under the conditions in such states, services for locating crippled children, and for providing medical, surgical, corrective and other services and care, and facilities for diagnosis, hospitalization, and after care, for children who are crippled or who are suffering from conditions leading to crippling. . . ." This is the authority for the activity undertaken in the states by the Crippled Children's Division of the Children's Bureau.

A third part of Title V (Section 541-b) might affect dentistry since congressional authority granted to the Children's Bureau permits it to "make such studies and investigations as will promote the efficient administration of this title. . . ." Perhaps this statement can be interpreted to mean that basic dental research concerning the etiology of dental diseases might be undertaken. Undoubtedly, it permits investigation of public health methods as they relate to dentistry.

In order to budget funds for dental programs under the provisions of Title V, certain rules and regulations need to be followed. For the sake of brevity, no attempt will be made to discuss these rules. In general, they are similar to the requirements for budgeting funds available under Title VI of the Social Security Act, which I propose to discuss in considerable detail.

BUDGET FOR STATE OR LOCAL HEALTH PROJECT

State: New Shan-gri-la

Project: Division of Dental Health

Period Covered by Budget: 7-1-41 — 6-30-42

Budget No. 93

Item No.	Item	24	Annual Rate	Amounts Budgeted 12 Months	Source of Funds				
					State	Local	U.S.P.H.S.		Other Agencies
							Title VI	V.D.	
	Salaries								
1	Dental director	1	5,100	5,100	2,550		2,550		
2	Dental supervisors	2	3,300	6,600	3,300	3,300			
3	Public health dentists	4	2,880	11,520				11,520	
4	Public health dentists	15	2,580	38,700	5,160		20,640		12,900 CB
5	Public health dentists	10	2,400	24,000		10,000	4,000		10,000 ComFd.
6	Consultant—health educators	1 (9 mos.)	1,800	1,350					1,350 CB
7	Clerk-typist	1	1,200	1,200	600				600 CB
8	Dental nurse	12 (P-T)	1,000	12,000		6,000	6,000		
	Other Personal Services								
9	Consultant, per diem $10		500	500	250		250		
10	Clinician, $3 per hour		3,000	3,000			3,000		
	Travel								
11	Dental director		900	900	900				
12	Dental supervisors	2	1,200	2,400	1,200	1,200			
13	12 employes		1,020	12,240					12,240 CB
	Other expenses								
14	Rent			360			360		
15	Equipment			1,300				500	800 PTA
16	Office supplies and expenses			800			800		
17	Maintenance			300	300				
18	Fixed charges (retirement and insurance)			400	400				
19	Printing and miscellaneous			200	100		100	100	
	Totals			122,870	14,760	20,500	37,700	12,020	37,890
(A)	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)

Title VI is administered by the Public Health Service, and according to Section 601 is "For the purpose of assisting states, counties, health districts, and other political subdivisions of the states in establishing and maintaining adequate public health services, including the training of personnel for State and local health work. . . ."[6]

Section 602 (a), under Title VI, states that the total amount appropriated each year shall be allotted to the states and the allotment shall be determined on the basis of (1) the population; (2) the special health problems, and (3) the financial need.

As indicated in the foregoing, a formula is applied to the annual appropriation ($11,000,000 in 1942) under Title VI to determine each state's allotment. The formula permits 27.5 per cent of the available appropriations to be based on the ratio of the population of each state to the population of the United States as shown by the latest official population estimates.

Forty-five per cent of the available appropriations are allotted after consideration of five special items. The first of these is the ratio of the mean annual number of deaths from certain infectious diseases in each state to the total mortality from these causes in the United States as shown by the latest census data. The second item is the need for regional training centers. The third item is the health need occasioned by military and industrial activities in critical areas. The fourth item is the special, unequal burden in administration created by population sparsity, and, lastly, the prevalence of malaria, hookworm disease, trachoma, typhus fever, similar geographically limited diseases, special industrial hazards and other conditions that result in an inequality of exposure to those hazards among the states.

The remaining 27.5 per cent of the funds is allotted upon the basis of the financial need of the state. The financial need is determined to be the ability of the state to raise revenue expressed indirectly in terms of differences in the per capita five-year income.

Section 602 provides that moneys so paid to a state shall be expended solely in carrying out the purpose specified in the act, and in accordance with plans presented by the health authority of such state and approved by the Surgeon General. State plans will be mentioned again later.

This section also provides that the Surgeon General shall determine, in accordance with rules and regulations previously prescribed by the Surgeon General, and after a conference of the state and territorial health authorities, the amount to be paid to each state. The payments are made quarterly. The money appropriated under Title VI is paid to the states from the Federal Treasury after certification to the Secretary of the Treasury by the Surgeon General.

Thus, after the allotments have been determined, the amounts allotted, on the basis of population and special health problems (except population density and the need for training centers), are available to the state when matched dollar for dollar by state or local public funds for public health services, as follows: (1) 50 per cent by an equal amount of existing appropriations of public funds for public health services; (2) 50 per cent by an equal amount of new appropriations of public funds for public health services made since January 1, 1935, or made prior to that date for the specific purpose of matching funds available under the provisions of the act.

Title VI allotments based on financial need, population density and the need for training centers are available without matching requirements. In effect, these allotments become outright grants. It becomes plain that state funds required for matching are considered as a whole and no consideration is given to specific health activities from which the funds stem. Therefore, federal funds are

available for dental programs that meet the requirements of the particular state health department involved.

One of the stipulations of importance in connection with federal aid is that no funds paid to a state pursuant to Title VI shall be used to replace state or local funds in such a way as to effect a conservation or reduction of appropriation for health work by state and local governments. It is evident, therefore, that every step is taken to increase state and local participation in health programs, and, in this way, Title VI of the Social Security Act functions as a system of grants-in-aid. It must be noted also that this system makes it impossible to institute federally controlled programs.

Each state is required to submit for the approval of the Surgeon General a plan for the improvement and extension of state and local public health functions. The plan shall also include: (1) a comprehensive statement of any changes in the state health organization (including personnel administration on a merit basis), programs and appropriations since the last statement was submitted, and (2) budgets on forms prescribed by the Public Health Service, itemizing the proposed uses and showing the source of all funds to be spent under the plan.

In other words, each state is required by the law to submit a plan showing what it proposes to do in the dental field, as it does in every other health activity. Extensive and new developments contemplated are to be shown also. The plan of the dental program should not contain past activities or progress made in previous years. Special reference should be made to basic changes created by the national war effort.

Before payment is made to any state, the state health officer submits to the Surgeon General for approval a budget for each project, state or local, in which the Public Health Service funds are to be utilized. In addition, the Public Health Service expects to receive a detailed budget for every division, bureau or section under the direction of the state health department, regardless of whether federal funds may be utilized in each individual project.[3] Only in this way can an adequate and complete picture be gained of the total program of the health department, and only in this way is it possible to show in a national annual report all the funds proposed for health work in the United States. If several specific public health programs are maintained under one division through separate units or sections, a budget should be set up for each section or program as far as is practicable. For example, a dental health section under the Division or Bureau of Maternal and Child Health should be budgeted as a separate project. Obviously, only by such measures are budget analyses possible.[3]

According to the Manual of Instructions for Preparation of Budgets, Budget Revisions and Financial Reports,[5] budgets are requested regardless of whether federal funds are employed, but only budgets submitted specifically for matching purposes and those utilizing Public Health Service allotments receive formal consideration by the Public Health Service.

When a state health department submits a budget (see sample), certain essential details need to be incorporated, such as the budget number, period covered by the budget and classification of budget items (salaries, other personal services, travel and other expenses). The Budget Manual also provides that the various items entered in the budget shall be numbered. For evaluation purposes, it is necessary that the budget items be accurately described. For instance, the "Title of Position" should describe clearly the character of the proposed expenditure. In the case of salary items, the description should indicate the type of work the employe performs or the functions in which he is engaged; e.g., "dental clinician—$5 per hour," or "consultant—$10 per diem." It is al-

ways important to show the schedule of fees when an annual salary is not the basis of reimbursement for services.

The annual rate and amount budgeted for each item are portions of the budget that must be properly filled in before the budget can be approved. The amounts (column D in sample) budgeted show a total of the amounts budgeted from all sources (sum of columns E, F, G, H and I). The column indicating contributions from other agencies (column I) should not only show the funds obtained for the program, but also the agency making the contribution, such as "C.B." for Children's Bureau, "P.T.A." for Parent-Teacher Association or "W.P.A." for Works Projects Administration.

No budget justifications are necessary on original budgets submitted for the continuation, without substantial change, of programs approved by the Public Health Service during the previous fiscal year. A "substantial change" is defined in the Budget Manual. A short but complete justification is needed for proposed new programs or the extension of established projects into a new activity. The justifications are typed on the reverse side of the sheet containing the items budgeted. Data relative to the qualifications of personnel on new projects should be supplied by correspondence only when requested by the District Office of the U. S. Public Health Service.

To further aid in classifying the activities of each state on a comparable basis as to functions rather than organizations, a system of functional coding was filled in on the form by the states for the fiscal year of 1942. The coding was applied to all activities regardless of the source of funds. The code number used for dentistry is 24, and it appears in the item box adjacent to the rate column. On the basis of the 1942 budgets, the Public Health Service will be able to continue the functional coding without direct coding by the states.

When all the foregoing prerequisites are met, the entire budget of a state health department and the state plans are forwarded to the District Office of the Public Health Service for approval. Any new program undertaken in a state is approved by the central organization in Washington. Discrepancies, deficiencies and errors are noted and the state is required to correct the irregularities before the budget is finally approved.

A narrative annual report is the one remaining requisite for satisfaction by a state of the regulations promulgated in regard to federal funds. At the direction of the health officer, the wise dental director prepares a simple narrative report, which follows item by item the plans submitted earlier in the year.

Up to this point, the discussion has been a detailed description of the mechanism for budgeting Title VI funds. In March 1942, the Division of Venereal Diseases of the Public Health Service indicated a willingness to approve, under certain conditions, the expenditure of federal venereal disease control funds in dental service programs. The conditions are based on the clinical experience that persons having a venereal disease, with poor oral hygiene and receiving antisyphilitic treatment with heavy metals, frequently are forced to suspend treatment because of oral reactions. Patients exhibiting optimum oral conditions are able to take larger doses of the heavy metals without oral symptoms and thus have little need for special care on the part of the officer in charge of venereal cases. A dental program using funds to check venereal disease truly approaches the health service that we have so often claimed it to be.

In addition to the three sources of federal money for dental programs already enumerated, another source stems from other provisions of the Social Security Act. Several state dental societies are now working with Public Assistance and Welfare agencies supported by federal and state tax funds.

Of considerable significance is the recent federal legislation[9] providing for loans to students whose professional education can be completed within two

years. The Kellogg Foundation has also granted funds to dental schools to supplement federal action. These two facts will probably keep the number of graduates at a prewar level. They are undoubtedly to be considered as strictly war measures. The Federal Government's interest in providing for continued production of professional people serves to emphasize the importance of the health of the public in the American way of life.

The administrator of public funds used in dental health programs, being an accountable public agent, is obligated to obtain the greatest returns in health, as any fiscal agent would be in like circumstances. This means that programs which apply known public health procedures and which are effective beyond a doubt usually receive prompt approval. In short, dental service programs on an economical basis are approved without question. Furthermore, available funds, the need for dental care, and the proved value of service programs present an ideal situation for the expansion of dental activities. Only energetic action and enthusiastic labor on the part of the dental profession and the directors of dental programs will take from the profession the onerous criticism resulting from the publicity concerning the vast number of draftees rejected for dental reasons.

Dental programs in most states are rather new and have previously included only the first few grades of elementary school children. In time of war, it seems desirable and fitting to pay more attention to dental programs for high school and predraft age groups. This is not meant to be a suggestion to curtail former activities. Quite the contrary. It is a suggestion to expand dental programs into fields where they are essential to national security.

The time has come when the efficiency of the individual laborer must be increased. Longer hours and increased working speed are taxing the worker's strength and resistance. It is up to the various health agencies and professions to see to it that strong, healthy men and women transform materials into fighting equipment in the shortest possible time. The responsibility is great. Former programs need to be expanded and made more effective. New fields need to be cultivated and available funds spent wisely. The men in public health dentistry are now in a position to justify their existence and to contribute invaluable assistance to their country and their profession.

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APRIL 1 *Editorial Department* 1943

FEDERAL AID IN PUBLIC HEALTH DENTISTRY

OUT of the long discussion of the evils and merits of so-called health insurance as a means of social security, there have come the Social Security Act of 1935 and its later amendments, which make provision for assistance to the various states in providing dental health service through the state health boards.

After almost two decades of effort to educate the public to the seriousness of mouth disease as an important contributory influence in systemic disease, a semi-official health conference called by President Hoover in 1931 gave full consideration to the question noted with the result that dentistry as a health service has been included in practically every discussion of the question since that time, and dental health service has played an important rôle in all general health programs.

It was after many years and tireless effort on the part of dentistry that we were accorded this recognition, but in the subsequent discussions of the disease implications of the unclean oral cavity, full recognition has now been accorded to dentistry as a health service.

In the discussion of health programs to care for the health of the pub-

lic, the American Dental Association has accepted the obligation of dentistry as a health service.

In the discussion of health programs designed to meet this obligation, the American Dental Association, at the height of the discussion of socialized medicine, formulated a plan by which dentistry could participate in a national health program. The plan constituted a three-point attack on the problem of dental disease which would include three basic principles: 1. Dental research to discover the causes of dental diseases. 2. Dental health education to bring a knowledge of present methods of prevention and control to the public. 3. Dental care particularly for children, as the greatest amount of prevention can be accomplished in this age group.

In order to express the attitude of the American Dental Association toward a national health program in a more practical way and in order to insure the rights of the public and the profession in such a program, the House of Delegates approved eight basic principles, which were formulated by the National Health Program Committee. The eight principles follow:

1. In all conferences that may lead to the formation of a plan relative to a (dental) health program, there must be participation by authorized representatives of the American Dental Association.

2. The plan should give careful consideration to: first, the needs of the people; second, the obligation to the taxpayers; third, the service to be rendered, and, fourth, the interests of the profession.

3. The plan should be flexible so as to be adaptable to local conditions.

4. There must be complete exclusion of non-professional, profit-seeking agencies.

5. The dental phase of a national health program should be approached on a basis of prevention of dental diseases.

6. The plan should provide for an extensive program of dental health education for the control of dental caries.

7. The plan should include provision for rendering the highest quality of dental service to those of the population whose economic status, in the opinion of their local authorities, will not permit them to provide such services for themselves, to the extent of prenatal care, the detection and correction of dental defects in children and such other service as is necessary to health and the rehabilitation of both children and adults.

8. For the protection of the public, the plan shall provide that the dental profession shall assume responsibility for determining the quality and method of any service to be rendered.

In our present issue, we are publishing a paper by Dr. Walter J. Pelton, of the United States Public Health Service, which interprets the application of each part of the social security law that involves dental service. Dr. Pelton also points out the desirability of participation of all

states in the program, indicating how the opportunities for amplifying the state health program can be made to redound to the credit of health service generally and to dental health service in particular.

It seems that there are two channels for aid to dentistry from the social security funds accumulated for the purpose of insuring health to the participants in the national health security project: through the United States Public Health Service and through the Children's Bureau, Maternal and Child Health Services. In the case of the Children's Bureau, the amount of the appropriation must be matched by the states participating in the project, but, in the case of the U. S. Public Health Service, the appropriation is an outright grant. While the percentage of the fund allotted to dentistry is not so large as could be desired as compared with that for all other health fields when divided among the forty-eight states, there are some states that have not availed themselves of the use of these funds and the monies have had to be turned back to the general social security fund.

In 1941, the total amount budgeted for all health services was $109,352,919, and of this amount, 0.6 per cent was budgeted for dental service.

In commenting upon the neglect of some states to avail themselves of this splendid opportunity for health service, the National Health Program Committee of the American Dental Association made this statement:

> Organized dentistry in this country has the definite duty of expanding its usefulness to the public by diminishing the effects of dental diseases upon the population. This can best be done by effective organization of the dental facilities of the state and community through the cooperation of governmental dental health officers and organized dentistry. . . .

The interest in health and dental care manifested by the government serves to emphasize the import of health service in the American way of life. This has probably been accentuated by the enormous number of those among the early war registrants who were rejected because of dental defects. And, as Dr. Pelton remarks:

> Only energetic action and enthusiastic labor on the part of the dental profession and the directors of dental programs will take from the profession the onerous criticism resulting from the publicity concerning the vast number of draftees rejected for dental reasons.

The dental profession can ill afford to allow this present opportunity for education in dental health matters to go by default. Surely it is the duty of every state society to see to it that the benefits of government appropriation for much-needed dental care are made available to the public.

NEW HEAD OF THE NAVY DENTAL CORPS

As we go to press, we learn that Captain Alexander Gordon Lyle has been commissioned Rear Admiral in the Navy to become head of the Navy Dental Corps.

A fuller notice of this momentous event will be made in a subsequent issue of THE JOURNAL.

DEATH OF DR. HENRY W. GILLETT

IT is with much sadness that we announce the death of Dr. Henry W. Gillett, of New York City.

An obituary notice of Dr. Gillett will be published in an early issue of THE JOURNAL.

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Stedman's Practical Medical Dictionary. 15th Edition.

By STANLEY THOMAS GARBER, B.S., M.D., University of Cincinnati, College of Medicine. 1257 Pages, illustrated. Price, with thumb index, $7.50; without thumb index, $7.00. Baltimore: The Williams and Wilkins Company, 1942.

STEDMAN'S Practical Medical Dictionary, for nearly thirty years recognized as a standard reference book, has been completely revised by Stanley T. Garber, of the University of Cincinnati, College of Medicine. The author has brought this edition up to date, and included many of the terms associated with recent medical discoveries. For example, about one page (1061) is devoted to definitions and chemical formulae of the sulfonamides.

The definitions of dental terms are usually clear and adequate, although not too critical. For example, caries is defined "a gradual decay with excavation of the dentine of a tooth, due possibly to the action of *Leptothrix buccalis*, commonly present in the mouth." The leptothrix has not, to this reviewer's knowledge, been seriously accused of causing caries since 1926. The pronunciation of gingiva is given as "jin-ji'-vah," which sounds odd, at least to midwestern dentists. No definition of "Vincent's infection" is given.

The Greek sources for words are printed in Roman letters, making it possible for the student to read without a knowledge of Greek. A helpful discussion of medical etymology is included in the preface. Other features include 23 full page plates, innumerable diagrammatic sketches and about 190 tables. The book has been entirely reset in new type, which was chosen for its legibility and clearness.

Every one reading scientific literature should refer constantly to a modern medical dictionary. Rather than try to guess the meaning of a strange word, one can find its exact definition quickly and easily in a good dictionary such as Stedman's Practical Medical Dictionary. M. K. HINE.

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WAR SERVICE COMMITTEE

PRICES OF DENTAL SUPPLIES FROZEN

THE War Service Committee announces that since January 18, 1943, all dental supplies have been under maximum price regulation No. 188, which maintains the price ceiling as of March 1942. In other words, the regulation freezes the prices of dental supplies at their highest values as of March 1942.

STUDENT DEFERMENT

THERE is quoted herewith Occupational Bulletin No. 11 (Amended March 1, 1943) with further reference to the question of student deferment. Dentistry again takes its proper position in the educational policies of the War Manpower Commission and the Selective Service System, in this bulletin, and all persons in the dental educational field are urged to study its contents thoroughly and govern themselves accordingly.

OCCUPATIONAL BULLETIN NO. 11
(AMENDED MARCH 1, 1943)

STUDENT DEFERMENT

1. General policy on student deferment. The War Manpower Commission has certified that there exists a serious need for additional persons in scientific and specialized fields and in certain of the professions. They are needed to perform vital services in activities essential to war production, to the support of the war effort, and in activities the maintenance of which is necessary to the health, safety and welfare of the Nation.

The subject of this occupational bulletin covers the eligibility of certain students for deferment. Careful consideration for occupational deferment should be given students included herein.

2. *Students, regular courses, scientific and specialized fields.*— (a) Undergraduate students: A student in undergraduate work in any of the scientific and specialized fields listed in paragraph (c) below should be considered for occupational classification if he is a full-time student in good standing in a recognized college or university and if it is certified by the institution that: (1) he is competent and gives promise of successful completion of such course of study and (2) if he continues his progress, he will graduate from such a course of study on or before July 1, 1945.

(b) *Graduate students:* A graduate or postgraduate student undertaking further studies in the scientific and specialized fields, listed in paragraph (c) below, on completion of his normal undergraduate course of study should be considered for occupational classification if, in addition to pursuing further studies, he is acting as a graduate assistant in a recognized college or university. A graduate assistant should be a student who, in addition to pursuing such further studies, is engaged in one of the following: (1) scientific research certified by a recognized federal agency as related to the war effort or (2) classroom or laboratory instruction in one of these scientific or specialized fields for not less than twelve hours per week.

(c) *Scientific and specialized fields:* The scientific and specialized fields are as follows: aeronautical engineers; automotive engineers; bacteriologists; chemical engineers; chemists; civil engineers; electrical engineers; geophysicists; heating, ventilating, refrigerating and air conditioning engineers; marine engineers; mathematicians; mechanical engineers;

meteorologists; mining and metallurgic engineers, including mineral technologists; naval architects; petroleum engineers; physicists, including astronomers; radio engineers; safety engineers; sanitary engineers, and transportation engineers—air, highway, railroad, water.

3. *Students, Medical, Dental, Veterinary, Osteopathic, Theological.* (a) Undergraduate, preprofessional students: A student in premedical, predental, preveterinary, preosteopathic and pretheologic fields should be considered for occupational classification if he is a full-time student in good standing in a recognized college or university, and if: (1) it is certified by the institution in which he is pursuing the preprofessional course of study that, if he continues his progress, he will complete the preprofessional course of study on or before July 1, 1945, and (2) it is certified by a recognized medical, dental, veterinary, osteopathic or theological college that he is unqualifiedly accepted for admission and will undertake professional studies upon completion of his preprofessional work.

(b) *Students in professional schools:* A registrant who is in training and preparation as a medical, dental, veterinary or osteopathic student in a recognized medical school, dental school, school of veterinary medicine, or school of osteopathy (a student preparing for the ministry in a theological or divinity school recognized as such a school prior to September 16, 1939, is exempt from training and service under the provisions of the Selective Training and Service Act of 1940) should be considered for occupational classification during the period of such professional course, provided he is a full-time student in good standing, and if: (1) he continues to maintain good standing in such course of study and (2) it is certified by the institution that he is competent and gives promise of successful completion of the course of study and acquiring the necessary degree of training, qualification or skill to become a recognized medical doctor, dentist, doctor of veterinary medicine or osteopath.

(c) *Interns:* A registrant who has completed his professional training and preparation as a medical doctor, dentist or osteopath, and who is undertaking further studies in a hospital or institution giving a recognized internship, should be considered for occupational classification so long as he continues such internship, but for a period not to exceed one complete year.

4. *Students of Agriculture, Forestry, Pharmacy and Optometry.*—(a) Undergraduate students: A student in undergraduate work in agriculture, forestry, pharmacy or optometry should be considered for occupational classification if he is a full-time student in good standing in a recognized college or university and if it is certified by the institution that (1) he is competent and gives promise of the successful completion of such course of study and (2) if he has completed at least one-half of his undergraduate work and, if he continues his progress, he will graduate in a number of months equal to the period of academic study which he has already completed.

Such deferment of students of agriculture, forestry, pharmacy or optometry should not be for a period beyond July 1, 1943, pending further consideration of the status of such students.

5. *Opportunity to Engage in Profession.*—When a registrant has completed his training and preparation in a recognized college or university, or his internship, and has acquired a high degree of training, qualification or skill, such registrant should then be given the opportunity to become engaged in the practice of his profession in the armed forces or in an essential civilian activity. In many instances, on graduation from a recognized college or university, or completion of an internship, a certain period of time will be required for placing such persons in an essential activity. When a registrant

has been deferred as a necessary man in order that he may complete his training and preparation, it is only logical that his deferment should continue until he has had an opportunity to put his professional training and skill to use in the best interest of the nation. Accordingly, on graduation in any of these professional fields or on completion of an internship, a registrant should be considered for further occupational classification for a period of not to exceed sixty days, in order that he may have an opportunity to engage in a critical occupation of his profession in the armed forces or in an essential civilian activity, provided that, during such period, the registrant is making an honest and diligent effort to become so engaged.

LEWIS B. HERSHEY, *Director*
C. WILLARD CAMALIER, *Chairman*
War Service Committee,
1726 Eye Street, N. W.,
Washington, D. C.

PROCUREMENT AND ASSIGNMENT SERVICE

PROCUREMENT AND ASSIGNMENT SERVICE FOR PHYSICIANS, DENTISTS AND VETERINARIANS

COMMITTEE ON DENTISTRY*

ANALYSIS OF THE AVAILABILITY OF DENTISTS, CONTINENTAL UNITED STATES

THE number of dentists available for the Army, Navy and Public Health Service, December 1, 1942, if a ratio of one dentist to each 2,500 persons is made the basis for estimated civilian needs, December 31, 1943, is as follows:

Number of dentists enumerated in the Federal Census, April 1940, 70,417.

Graduates, 1940-1943, inclusive, 8,928.

Total, including additions to the profession through 1943, 79,345.

Deaths and retirements (total and partial), April 1, 1940-December 1, 1942, 3,830.

One-third of dentists holding full-time appointments, 1,021.

Exclusions—total, 4,851.

Number of effective dentists, 74,494.

Number of dentists required for an estimated civilian population of 125,625,000, December 31, 1943, at a ratio of 1 dentist to 2,500 population, 50,250.

Allowance for replacements for deaths and retirements, December 1, 1942-December 31, 1943, 1,624.

Total required, 51,874.

Total available, 22,620.

Dentists on extended active duty, December 1, 1942: Army, Navy, 11, 416.

Public Health Service, Commissioned Officers, 201.

Total made available to Army, Navy and Public Health Service, 11,617.

Balance available, December 1, 1942, 11,003.

STATEMENT REGARDING THE AVAILABILITY AND ALLOCATION OF DENTISTS

The problem of determining the number of dental practitioners that can be made available to the armed forces without too seriously decreasing the availability of dental care to the civilian population is a difficult one. Solution of this problem and that of allocation involve consideration of the number of active dentists in the United States, the death and retirement rates in the dental profession, the age group distribution of dentists, the demand for dental care and a

*Prepared by J. T. O'Rourke, chairman, Committee on Dentistry, Procurement and Assignment Service.

Based on statistical data presented by George St. John Perrott, director, Division of Public Health Methods, U. S. Public Health Service, and member of the Committee on Allocation of Medical Personnel, Procurement and Assignment Service.

large number of other factors. At several points, satisfactory information regarding those factors was not available. Consequently, where this was true, it was necessary to proceed on the basis of arbitrary assumptions or standards. However, it is felt that the conclusions reached give adequate consideration to the needs of the civilian population in an emergency situation, and provide an equitable basis for the allocation of dentists.

I

To determine the number of dentists available for the armed services, and for the civilian population, it was first necessary to ascertain the number of active dentists in the United States. To this end, it seemed desirable to use the enumeration of the Federal Census, April 1, 1940; for the dentists included in this enumeration (70,417) were listed as "employed" or "seeking work." It was therefore assumed that this enumeration closely approximated the total number of active dentists. To this number of active dentists was added the graduates of 1940 (1,757), 1941 (1,568) and 1942 (1,784), and the estimated number of graduates in the two classes of 1943 (3,819). It was assumed that this, without considering deaths or retirements, would give a total of 79,345 active dentists up to December 31, 1943.

From this total number of active dentists (79,345), it was necessary to make deductions for deaths and for total and partial retirements from April 1, 1940 to December 1, 1942 (3,830). For this purpose, a combined death and retirement rate of 20 per thousand was assumed.

A tabulation by the National Institute of Health of data from 59,986 questionnaires returned in the enrollment of dentists by the National Roster of Scientific and Specialized Personnel as of August 1942 indicated that 4.3 per cent of those dentists held full-time appointments of the following types: service in state or local health departments or hospitals, teaching and research, and in several federal agencies exclusive of the U. S. Public Health Service. It was estimated that approximately two-thirds of these dentists were providing dental service, and that one-third were engaged in activities not involving practice. Therefore, this one-third, or 1,021 dentists, were deducted from the total number of active dentists.

The deductions for deaths and retirements and for one-third of the dentists holding full-time appointments total 4,851. This number subtracted from the total 79,345, which represents the dentists enumerated in the Federal Census, April 1, 1940, and the additions to the profession through 1943, gives 74,494 as the number of effective dentists and new graduates available for both the civilian population and the Army, Navy and Public Health Service.

It was assumed by the Committee on Dentistry that the intensity of practice by active dentists had increased to a point where the national dentist-population ratio of 1:2,500 would not reduce the availability of dental care to the remaining civilian population to a dangerous point. The Committee realized that there is a wide difference in the dentist-population ratio among the various states. However, it has been assumed that differences in the peace-time ratio reflected variations in the per capita income, character of the population and a number of other facts; and that with the passage of time existing ratios had come to be fairly representative of the effective demand for dental service in each state.

It was estimated that there would be a population of 136,625,000[1] as of December 31, 1943, including those in the armed forces. For the purpose of arriving at an estimate regarding the population which would remain after withdrawal of individuals for the armed forces, it was necessary to deduct 11,000,000, as representing the total withdrawal of enlisted personnel, officers and men on leave and in hospitals, nurses,

1. Estimate by National Institute of Health.

WAAC's, WAVE's, and SPAR's. This deduction gave an estimated remaining population of 125,625,000 to which the ratio of 1:2,500 was applied.

On the basis of a remaining population of 125,625,000, and at a ratio of one dentist to 2,500 population, 50,250 dentists would be required for the civilian population up to December 31, 1943. In addition, allowance for deaths and retirements from December 1, 1942 to December 31, 1943 was necessary. Since the average age of the dentists in practice would increase with the withdrawal of those under 39 years of age, it was necessary to apply a different death and retirement rate. This rate as estimated by the National Institute of Health is 31.3 per thousand active dentists, and on the basis of this rate, the allowance for deaths and retirements for the thirteen months period would be 1,624 dentists.

If the allowance of 1,624 dentists is added to the 50,250 required to maintain a ratio of 1:2,500, the total number of dentists required for the remaining civilian population to December 1, 1943 will be 51,874 (50,250+1,624). Subtraction of this number from the total number of effective dentists (74,494) would give the number of practitioners and new graduates available for the Army, Navy and Public Health Service.

According to the Office of the Adjutant General of the Army, and the Bureau of Naval Personnel, there were 11,416 dentists on extended active duty as of December 1, 1942. In addition, there were, according to the United States Public Health Service, 201 commissioned dental officers in that branch of service, or a total in the three services of 11,617. If this number is deducted from the total available (22,620), the balance available as of December 1, 1942, would be 11,003, and it is from this balance that the dental personnel needs of the Army, Navy and Public Health Service are to be met in 1943. It is assumed, of course, that this balance represents only men who can qualify on a complete or limited service basis, and who can be cleared by State Procurement and Assignment Committees.

II

Although dentists were not recruited on a quota basis during 1942, such a basis had to be assumed before the 1943 needs could be properly allocated, and state quotas organized with regard for the contributions that each state had made to the total requirements of 1942. The total number of dental officers required in 1942 was 12,700. Of this number, 651 were already in the regular corps of the Army and Navy. In addition, it was estimated originally that 1,427, or 80 per cent, of the 1942 dental graduates would be eligible for military service (i.e., 80 per cent of 1,784 graduates). A central quota of 2,078 was thus established for 1942, 651 Regular (prewar) Dental Corps, Army and Navy, plus 1,427 eligible graduates from the class of 1942. The total states' quota for 1942, therefore, amounted to 10,622 (12,700 minus 2,078).

SUMMARY OF DATA

	1942	1943	1942-1943
Total dental officers required (Army and Navy)	12,700	9,500	22,200
Central quota, total	2,078	2,616	5,694
Regular Corps, Army and Navy	651	—	651
Eligible dental graduates:			
1942 (one class)	1,427	179	1,606
1943 (two classes)		3,437	3,437
States' quota	10,622	5,884	16,506

The quota of dentists for 1943 was determined as follows:

The total number of dental officers required by the Army and Navy in 1943 (as reported to the Procurement and Assignment Service on December 28, 1942) is 9,500. The most recent estimates made by the Army indicate that 90 per cent of the dental graduates are eligible for military service. On this basis, it is

estimated that 3,437 graduates of the two classes of 1943, and 179 additional graduates of 1942 would be eligible for military service. A central quota of 3,616, therefore, was established for 1943 (i.e., 3,437 plus 179). The total states' quota for 1943 amounted to 5,884 (9,500 minus 3,616).

A tabular summary of the foregoing data is shown herewith.

The method used in computing the 1942 states' quota was as follows: The number of dentists in each state as enumerated in the Federal Census, April 1, 1942, was related to the 1940 population. These ratios were used to weight the number of dentists in each state, and a weighted total for the United States was derived. The 1942 states' quota was distributed among the states in proportion to the weighted number of physicians in each state.

The method used in determining the number of dentists required to meet the 1942 and 1943 states' quotas as of November 30, 1942 was as follows: The number of dentists enumerated in the 1940 Federal Census was taken as the prewar base. The number of dentists who would have been in each state, December 31, 1942, if the first quota had been exactly met (with no state having either a deficiency or an excess) was computed and expressed as a ratio to the estimated civilian population, December 31, 1942. (Preliminary population estimate No. 1 prepared by the National Institute of Health.) A weight for each state to be used in determining its second quota was computed by multiplying the number of dentists by the foregoing ratio.

The number of dentists to be distributed among the states for the second quota was determined as follows:

Needs of armed forces for 1943 (revised as of December 28, 1942) 9,500.

Number of dental graduates of 1943 estimated to be eligible for service (90 per cent of total), 3,437.

Additional number of 1942 graduates estimated to be eligible for service, 179.

Total to be obtained from recent graduates, 3,616.

Number of dentists to be obtained from states, 5,884.

Number of dentists still to be inducted to fill deficit from first quota in fifteen states with a deficit as of November 30, 1942, 2,088.

Number of dentists in military service in excess of first quota for thirty-two states with an excess as of November 30, 1942 (two states exactly met their first quotas), 1,283.

Number of dentists still to be inducted as of November 30, 1942 to fill quota for all states combined, 805.

Total number of dentists still to be inducted to meet deficit in first quota and to fill second quota, 6,689.

The 5,884 dentists were distributed among the states in proportion to the weighted number of dentists (as described above) in each state. As of November 30, 1942, thirty-two states had exceeded their first quota, the sum of these excesses being 1,283. For each of these states, the excess over sixteen of these states (Alabama, Arizona, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Mississippi, New Mexico, North Carolina, Oklahoma, South Carolina, Tennessee, Texas and Virginia) also had contributed dentists in excess of the sum of their first and second quotas, the total in excess being 520. This number was credited to (subtracted from) the quotas for the remaining thirty-three states in proportion to the weighted number of dentists, computed as described above.

It should be noted that the dental graduates estimated to be available for military service have been taken into account in establishing the central quotas. For this reason, dental graduates who enter active duty are credited to the central quota rather than to the states' quotas. The records of all dental officers on active duty as of November 30, 1942 have been compared with a list of the dental graduates of 1942 in order to segregate the 1942 dental graduates creditable to the central quota for 1942, from dentists to be credited to the state quotas for 1942.

To be sure that each state received credit for dentists leaving that state for extended active duty, the places of residence given by these dentists were carefully checked against the records of the American Dental Association. This checking service was provided through the generosity of the War Service Committee of the American Dental Association.

Committee on Dentistry,

J. T. O'ROURKE, *Chairman*

L. M. S. MINER

GUY S. MILLBERRY

F. B. NOYES

B. K. WESTFALL

GEORGE ST. JOHN PERROTT, Director, Division of Public Health Methods, U. S. Public Health Service, and Member of Committee on Allocation of Medical Personnel, Procurement and Assignment Service.

G. D. TIMMONS, Consultant, War Service Committee, American Dental Association.

BUREAU OF PUBLIC RELATIONS

DIET AND DENTAL HEALTH*

THE kind of food eaten each day plays an important part in dental health. There would be better appreciation of this fact if dietary indiscretions were followed promptly and specifically by their bad effects, or if it were as easy to check one's health status as the status of one's bank account.

The diet of the average individual is fundamental to the development and maintenance of the teeth, jaw bones and soft tissues of the mouth. In addition, it probably influences the amount and severity of decay in both primary (baby) and permanent (adult) teeth. The influence of diet starts in the prenatal period and is active continuously thereafter, throughout infancy, childhood and adulthood.

The oral cavity, unlike other parts of the body, may not only be affected by the nature of food that is digested and assimilated: it may also be affected by the food residues in the mouth. While such residues contribute nothing to the nutrition of the body, they may contribute much to the degeneration of the teeth, particularly if bacteria act upon the residues to produce acids. For these reasons, food should be intelligently chosen.

TOOTH DEVELOPMENT

If the prospective mother has an excellent diet, supplying all the building elements and in the quantities recommended by nutrition authorities, the deciduous teeth of the child will be better formed. Although most of their crown structure is formed before birth, the primary teeth continue to form and are completed after birth. The permanent teeth are formed after birth. The enamel that covers the crowns of the teeth, except that of the third molars, or wisdom

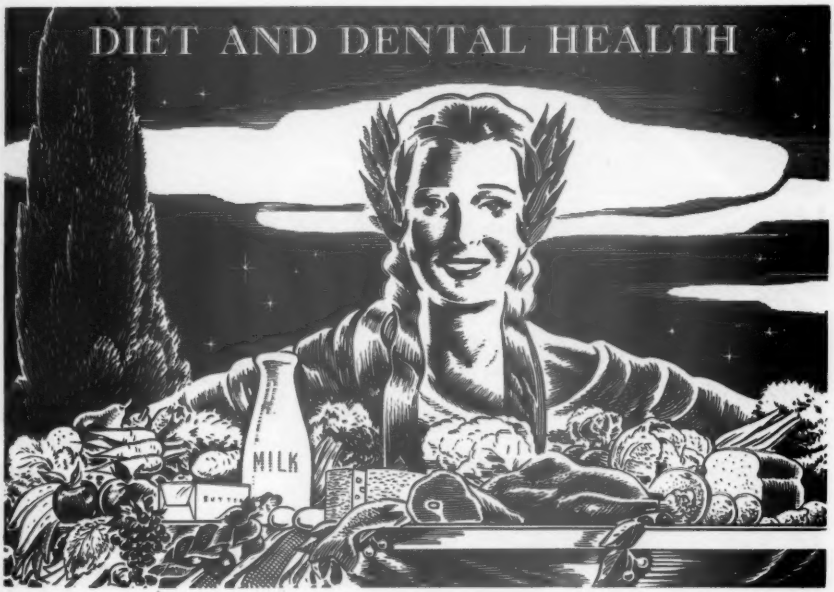
*The growth of public interest in dental health has resulted in a marked increase in requests for information on different phases of the subject. To meet this demand, the Public Health and Education Committee, now a committee of the Council on Dental Health, has authorized the preparation of a series of twelve articles in pamphlet form, each article to deal with one of the dental questions most frequently asked by the public.

"Diet and Dental Health," by Dorothea F. Radusch, D.D.S., is the fourth of this series. Reprints can be obtained by addressing the Bureau of Public Relations, American Dental Association, 222 E. Superior St., Chicago, Ill.

teeth, is fully formed by 7 to 8 years of age, in each case about three or four years before the teeth erupt through the gums.

The diet during the formative period of the teeth should supply adequate amounts of all the vitamins and minerals, even though certain ones may be relatively more important at different times. Without an adequate intake of vitamin A, the tooth bud cannot be normally formed; and no matter how ample the supply of tooth-building elements is later, the tooth will be of defective structure. Several workers have verified this fact by research on animals, showing that deficiencies of vitamins A and D and of minerals result in poor tooth structure. Vitamin A is supplied principally by green or yellow foods, whether they be vegetables such as spinach, squash and peas; fruits like apricots and bananas, or dairy foods, such as butter and milk, or eggs. In spite of available sources, even before the World War a shortage of vitamin A was very common. Studies of food consumption habits in the United States have shown that about 40 per cent of the people receive less than half the amount of vitamin A necessary for good nutrition, and 75 per cent receive less than the standard requirement.

Other factors in the development of the teeth, jaws and gums, as well as of the rest of the body, are calcium, phosphorus, vitamin D and vitamin C. Milk is the only food that is rich enough in calcium (lime) to supply the required amount for daily needs. The huge quantities of fruit and vegetables that would be necessary to furnish like amounts of calcium make it almost impossible for human beings to obtain enough calcium from these sources.



In addition to its vital rôle in providing calcium, milk contains other elements to improve and fortify the diet. But do we, as children or adults, obtain enough calcium in our ordinary daily meals? A great many studies indicate that we do not.

Scarcity of Protective Minerals and

Vitamins in Average Diet.—Typical findings are those in which of 1,624 children in the sixth and seventh grades, only 31 per cent daily received the minimum standard of 1 pint of milk, three servings of vegetables and fruit and one serving of protein (meat, fish, cheese, legumes). Eating between meals was common, with sweet food predominating. In another instance, children who showed extensively decayed teeth were found to present evidence of cured rickets and other indications of poor nutrition, past and present. Half of them were taking less than a pint of milk, and 85 per cent received insufficient amounts of fruit and vegetables.

Careful studies of the milk-drinking habits of high-school pupils indicate that even though 96 per cent of the boys and 88 per cent of the girls liked milk, many did not drink it regularly for various reasons such as: they did not want to gain weight, or they felt that milk drinking indicated immaturity. It was found too that the more milk parents drink, the more their children drink. But parents do not use milk frequently enough, even though adult diets furnish enough calcium only when they contain liberal amounts of milk. Without question, milk is important at all ages, and should be omitted only by the few people whose physicians have found that they cannot tolerate it.

When one considers the beneficial effects upon general and dental health when diets are improved, the high frequency of poor diets is recognized as a serious matter. Some research workers report a significant reduction in the average number of new cavities in the teeth of children receiving dietary guidance, as compared with those not receiving it.

The primitive Eskimos' teeth were free from decay until traders introduced them to civilized foods such as sugar, molasses and refined flour.

VITAMIN D

In order to utilize calcium and phosphorus effectively and economically, vita-

min D is necessary. It is vital not only during the tooth-forming period, but also continuously thereafter. No single common food contains adequate amounts of it. Perhaps the normal source should be the sun, but smoke, soot, fog, clouds, clothing and indoor living prevent the vitamin D rays of the sun from reaching us. Thus the sun is a variable and undependable source of vitamin D activation for many children and adults. This is especially so in northern areas like Canada and the upper United States, and in any area for persons kept in school or at work during the hours of possible sunshine. Vitamin D is undoubtedly necessary at all ages and it is especially necessary for the growing child.

EFFECT OF SUGAR

That sugar and other refined carbohydrates are apt to promote tooth decay has been indicated by many studies in schools and other institutions and also by the observation that primitive Eskimos were free from decay until "civilized" foods were introduced, by traders. These foods were mainly sugar, molasses and refined flour.

Some believe that the possible detrimental action accompanying the use of sweet foods is due to action of the sugar itself. Others believe that failure to include the protective foods in the diet when sweets are used in quantity is the chief reason.

In any case, it is generally accepted that the majority of children on sugar-rich diets have more dental decay than those on low-sugar diets. By "sugar" is meant, in addition to the substance itself, any food or drink containing added sweetening, such as candy, ice cream, cake, commercial sweet drinks, jellies and jams.

The capacity of the individual for food has certain limitations. If sufficient food to furnish the required calories and recognized dietary essentials is eaten each day, it is comparatively easy to control the appetite for and intake of additional amounts of sugar and refined flour products. For example, a 9-year-old boy usually eats about 2,000 calories a day. If he has a quart of milk, 1 egg, 1 serving of meat, 1 orange, 1 potato, 1 serving of cooked vegetable, 1 salad, an apple or other fruit, 1 serving of breakfast cereal, 4 slices of bread with butter and cod liver oil as prescribed by the physician, there is only from 100 to 150 calories remaining for sugar or sweet foods. If he uses sugar on the breakfast food and jam on the bread, the quota will be fully met. Even a single average size serving of frosted cake would give him more than his allowance, since in it there are about 200 calories from sugar alone. Consumption of a candy bar or two average size pieces of chocolate fudge would mean no further sweets for the day.

The same type of computation for persons of all ages will disclose the same fact: that if normal weight is maintained, it is impossible to include the usual amounts of desserts, soft drinks and candies without pushing some essential elements out of the day's food quota. If concentrated sweet foods are eaten, in addition to those needed to furnish essentials, the child or sedentary adult will necessarily become overweight.

PYORRHEA

The substitution of foods rich in calories, but poor in other dietary essentials, is unwise from the standpoint of a disease of the gum, i.e., pyorrhea. The jaw bone and the gums are constantly changing in structure. Most tissues are not fixed for life after they have been formed. Experiments on animals have shown that when sufficient minerals or vitamins are not supplied by the daily foods, some minerals are withdrawn from the jaw bone, which then becomes porous and cannot support the teeth adequately. It has also been found that human beings with a low food-calcium intake are more

likely to have diseases of the tissues surrounding the teeth.

Teeth and their supporting tissues need exercise. From about the twelfth month and throughout life, some coarse food should be eaten each day, in order to stimulate and strengthen the gums, the muscles of mastication and the periodontal membrane. Thorough mastication also increases the flow of saliva, which aids in the digestion of food. Eating celery, raw carrots and cabbage, apples and other fresh fruit, coarse grain bread, cereals, toast, crusts and roasted or broiled meat helps to exercise the teeth.

A spongy, unhealthy condition of the gums may result from an inadequate intake of the vitamin B group or vitamin C. This condition is easily recognized when these vitamins are so lacking that soreness of the mouth indicative of pellagra or scurvy develops. Of greater importance to most people are the more frequent mild deficiencies which do not result in typical pictures of disease.

A single serving of citrus fruit or tomatoes will furnish most of a day's requirement of vitamin C under ordinary circumstances. But no single common food will supply comparable amounts of the various vitamin B complex factors. All the classes of foods mentioned in the recommended dietary pattern contribute to the daily need of these factors.

DIETARY RECOMMENDATIONS

Since the mouth and teeth are a part of the whole body, their nutrition cannot be separated from the general nutrition. The dietary pattern planned to meet the standards of general and dental health is as follows:

Milk: 2 or more cups daily for adults, 3 to 4 or more for children.

Meat (fish, poultry, cheese or legumes): 1 or more servings daily.

Eggs: 1 daily preferred; at least 3 to 5 a week.

Butter: 1 or 2 tablespoons daily.

Vegetables and fruits: 5 servings daily, 1 of citrus fruit or tomato; 1 serving of potato; 1 serving of green or yellow fruit or vegetables; 2 other servings of fruit or vegetables.

Breads and other cereal foods (foods composed predominantly of grain products): 4 to 6 servings daily), at least half of it whole-grain or enriched.

Desserts: Preferably, once daily. If served twice daily, the second serving should be permitted only when it will not displace protective foods. End the meal with natural fruit rather than sweetened desserts.

Calculations of diets based on the foregoing pattern showed that they met, in virtually all cases, the dietary allowances compiled by the Committee on Food and Nutrition of the National Research Council. The allowances were planned according to the latest scientific knowledge of foods and their contribution to health, strength and morale.

To this dietary pattern, vitamin D, when not available from the sunshine, should be added in amounts according to recommendations for the age. With this exception, it is better to buy one's vitamins and minerals at the grocery store rather than over a drug counter.

CONCLUSIONS

Diets in common use consist of foods low in protective value. Surveys of eating habits show clearly the need for education of both children and parents regarding food values and meal planning. If we could improve national food habits, tooth decay and gum disease, including pyorrhea, could be reduced for the population at large. To do this, there must be a more widespread recognition of the importance of a diet including generous amounts of the various foods suggested in the dietary pattern. The right kind of food is essential to health, including dental health.

However, an adequate diet in itself is no absolute guarantee against tooth decay. Many times, caries occurs in spite of the fact that the individual or the family attempts to maintain an adequate diet.

Those charged with the responsibility of maintaining the health of the family, and particularly the health of the children of the family, might well be guided by the following rules:

A. Provide a balanced diet each day (as given on page 592).

B. Reduce the family sugar consumption to a minimum.

C. Include in each day's menu some foods that require vigorous chewing.

D. Insist that each member of the family clean the teeth as soon after each meal as possible.

E. Insist that the teeth of each member of the family be frequently examined by the dentist and that all incipient dental defects be immediately and properly corrected.

COUNCIL ON DENTAL HEALTH

HIGH SCHOOL VICTORY CORPS PHYSICAL FITNESS DENTAL PROGRAM

MARCH 15, the Council on Dental Health launched its nation-wide High School Physical Fitness dental program. This program has been developed to take care of the dental needs of high school students, particularly those who are about to enter the armed forces or civilian war services.

The dental phase of the Victory Corps program has been endorsed by John W. Studebaker, U. S. Commissioner of Education, as well as by the Board of Trustees of the American Dental Association. Its details were worked out by the Council in cooperation with staff members of the U. S. Office of Education.

Letters from J. Ben Robinson, President of the American Dental Association, have been sent to all state and component dental societies, urging them to cooperate with their high school officials. Similar letters have been mailed by Dr. Studebaker to all state superintendents of public instruction, urging them to cooperate with the state dental society.

The Council on Dental Health has mailed a copy of the Victory Corps Packet to all state and component societies. This packet contains detailed suggestions which will aid societies in setting up a Victory Corps Physical Fitness dental program in their community. All dentists are urged to give prompt and special consideration to the dental needs of high school students.

Copies of four pieces of educational material which are recommended by the Council on Dental Health to implement the educational phases of the program are illustrated on the following page, consisting of two posters in four colors, one for boys (C) and one for girls (D); a booklet entitled "Facts About Teeth and Their Care" (A), for teachers, and a leaflet, "Fighters, Workers, Keep Fit" (B), for high school students.

The Council recommends that the dental phase of the High School Victory Corps Physical Fitness program be developed as a cooperative effort on the part of the state department of public instruction, the state department of health and the state dental society. It is hoped that all dental societies will participate as this will be one more method by which dentistry can contribute to the war effort.

Educational material recommended by Council on Dental Health to implement program.

COUNCIL ON DENTAL THERAPEUTICS

ENDOCRINES AND DENTISTRY

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Chicago, Ill.

THE Council has authorized publication of this report as one of the series on pharmacology and therapeutics to be published by the Council. The opinions expressed are those of the authors and do not necessarily reflect the opinion of the Council.

DONALD A. WALLACE, *Secretary.*

INTRODUCTION

The increased understanding of the rôle of the endocrine glands in normal and in abnormal growth and development represents an outstanding achievement of medical science. The rapid advances in this field have come from the combined efforts of physicians, who have carefully analyzed the condition of patients suffering from endocrine dysfunction; physiologists, who have removed the glands and experimented with replacement therapy, and chemists, who have prepared and purified extracts of the glands.

At the same time, the striking disturbances in metabolism and in growth that result from endocrine dysfunction have led to the common error of regarding the endocrines as responsible for many disturbances the source of which cannot at present be proved. While certain symptoms can be associated with a particular endocrine dysfunction, it does not necessarily follow that such symptoms must always be due to such dysfunction. Unjustified enthusiasm has occasionally been displayed in the therapeutic application of new glandular products, as if, by the mysticism of organotherapy, we might accomplish a miracle of cure. It must be pointed out that most of the available endocrine extracts are not yet prepared in pure form; that our knowledge of the physiologic activity of these preparations is as yet incomplete, and that the proper dosage is therefore not yet determined. Careless organotherapy may have unexpected and possibly harmful results.

Advances in the field of endocrinology have been made with such rapidity that it is difficult for the average practitioner, medical or dental, to keep abreast of the newer knowledge and new developments in this field. For this reason, a survey was undertaken of the more important clinical and experimental advances in this field.

Functions of the Endocrines.—In order to understand the effects of endocrine dysfunction, it is essential to understand the normal functions of these glands. The endocrines constitute a very important factor in the internal environment. Their secretions enter the blood stream and influence the activity of distant cells. When the endocrine hormones reach the cells, they play the rôle of catalyzers, which accelerate or decelerate basic cellular processes, such as growth, differentiation and metabolism. It is important, however, to recognize that these hormones do not initiate new cellular or metabolic activities, but serve merely to regulate their rate of development, as a valve regulates the rate of flow of water. Since the hormones affect similar cells in different parts of the body, they serve not only to regulate, but also to coordinate the rates of cell processes and

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Acknowledgement: This study was made possible only through the cooperation of the various members of the Child Research Council. The clinical material was supplied to the Child Research Clinic, for the most part by the Department of Pediatrics, University of Illinois, College of Medicine, through the cooperation of I. P. Bronstein and H. G. Poncher. The headplates used in this study were taken on the Broadbent-Bolton cephalometer housed in the Department of Orthodontia, University of Illinois, College of Dentistry, through the courtesy of Allan G. Brodie.

to link the functional activities of different organs, thus insuring harmonious and integrated performance. (Zondek.*)

The intensity of the endocrine effects will differ in growing and non-growing tissues or sites and therefore the result will vary with the age of the patient.

Dental Considerations.—The teeth and jaws, as part of the total body economy, reflect endocrine dysfunction just as do other organs and tissues. Because of their ready accessibility for clinical examination, the many developmental stages through which they pass and their highly specialized structural characteristics, they prove to be valuable for the analysis of endocrine dysfunction. They are often able to reflect these effects with kymographic accuracy.

An understanding of the normal development of the teeth and jaws is essential to appreciation of the aberrations that result

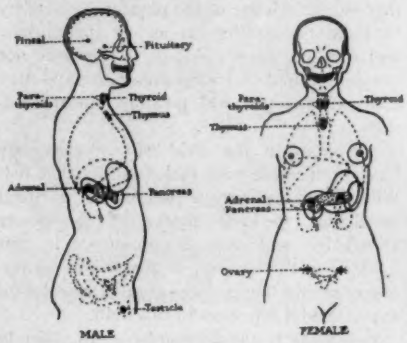


Fig. 1.—Location of various endocrine glands. (Redrawn from August A. Werner, Hygeia, November 1940.)

from endocrine dysfunction. For a recent summary of tooth development and the effects of the endocrines on the teeth, the reader is referred to the first two chapters of Gordon's "Dental Science and Dental Art" (Schour) and to Schour and Massler. A description of the normal growth pattern of the jaws and face is given by Keith and Campion, Hellman, Brash, Broadbent and Brodie.

Scope of This Report.—The analysis of the changes in the teeth, jaws and facial skeleton will be preceded by a discussion of the rôle of each endocrine gland in terms of its effect upon the general body economy, somatic growth and development, upon craniofacial development and upon the teeth. The findings in man will be supplemented by those obtained in experimental animals. Emphasis will be placed, wherever possible, on the clinical aspects of the subject matter.

It must be pointed out that in man we often see the effects of the dysfunction of more than one endocrine gland rather than the hypofunction or hyperfunction of a single gland. It is only in experimental studies, and not even in all of these, that we are able to speak of relatively pure cases of underfunction or overfunction.

THE PITUITARY

Origin and Location.—The pituitary gland,

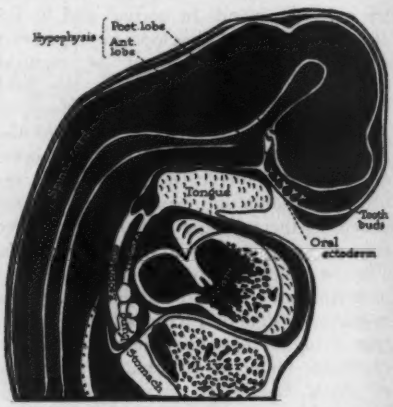


Fig. 2.—Ten millimeter pig embryo cut in sagittal plane. The sites of future tooth development are drawn in to show the common derivation of the anterior pituitary and the teeth from the oral ectoderm. (Adapted from B. M. Patten, "Embryology of Pig," Ed. 2. Philadelphia: P. Blakiston's Son & Co., 1931, Fig. 60.)

or hypophysis, is an ectodermal derivative, about 15 mm. in diameter and weighing 0.5 gm. It is housed within the protecting sella turcica in the center of the base of the skull. (Fig. 1.) An interesting embryologic fact is that the anterior lobe, like the teeth, is derived from the oral ectoderm. (Fig. 2.) This common derivation explains the occasional

*A bibliography follows Part III.

presence of teeth in pituitary tumors. (Schurman, Pfluger and Norrenbock.)

Function.—The pituitary is the master endocrine gland in the body. It regulates the rate of growth and the metabolism of nitrogen and water. Its secretion contains many hormones, each of which has specific effects. Because some of these hormones act upon the other endocrine glands (thyrotropic, adrenotropic, gonadotropic, lactogenic, etc.), the function of the pituitary has been compared to that of the conductor of a symphony orchestra.

Growth Hormone.—The two pituitary secretions of which most is known are the growth and the gonadotropic hormones. The growth hormone, secreted by the acidophilic cells, controls the rate of growth of all organs and tissues (except the uterine), particularly of bone and muscle. Since the growth hormone is effective only when the cells are receptive, that is growing, its influence is absent in those parts where growth is complete.

So far as the basic effect of the growth hormone is exerted on the rate of growth of all cells and tissues, the gross endocrine effects are quantitative rather than qualitative; that is, a deficiency in growth hormone during the period of rapid growth gives a hypoplastic pattern (smaller size, but normal proportions), while an excess produces a hyperplastic pattern (larger size and expected proportions). A dysplastic pattern, the result of a selective action, is manifested in a disproportion of parts such as occurs in cretinism and achondroplasia.

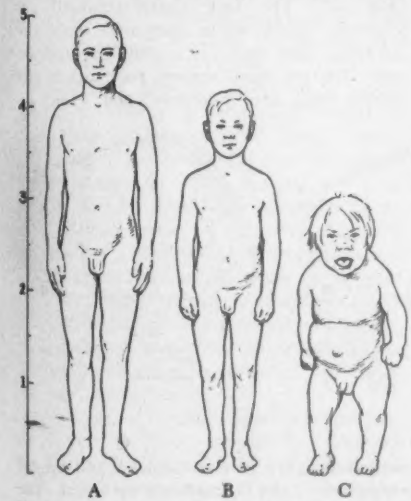


Fig. 3.—Composite drawings of male patients. A, normality; B, hypopituitarism, and C, congenital untreated hypothyroidism (cretinism). The smaller size but symmetrical proportions are to be noted in B and the dysplasia in C. (Composite drawings of figures in Wolf's "Endocrinology," Zondek's "Diseases of the Endocrine Glands" and photographs supplied by I. P. Bronstein.) In A, the chronologic age is 13 years; statural age, 12 years; height, 5 feet. In B, the chronologic age is 13 years; statural age, 8 years; height, 4 feet 2 inches. In C, the chronologic age is 13 years; statural age, 2½ years; height 3 feet 1 inch.

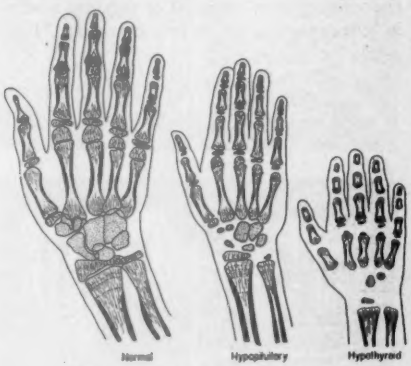


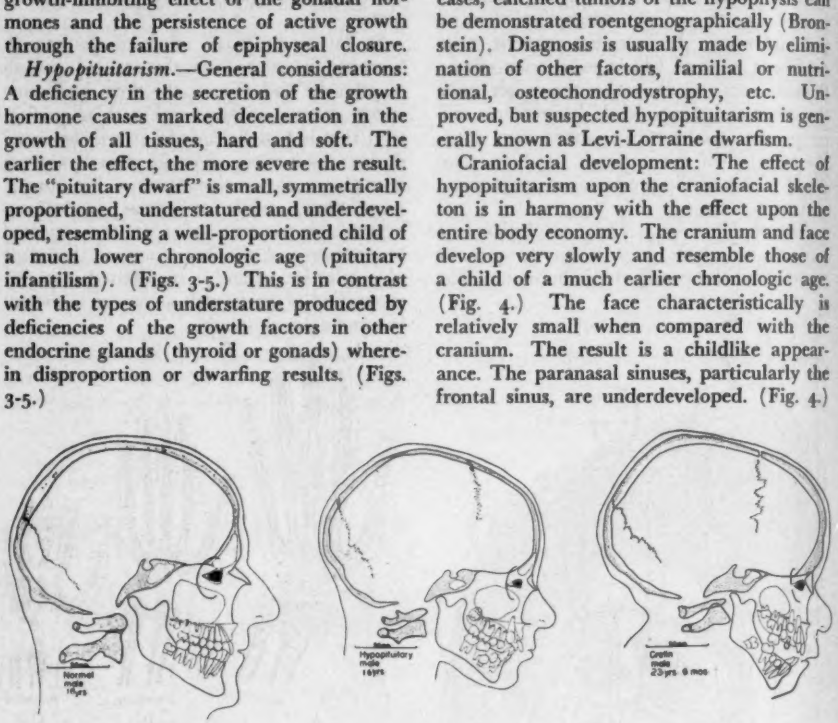
Fig. 4.—Composite tracings of handplates taken of patients and similar to those shown in Figure 3. A, normality; B, hypopituitarism, and C, congenital untreated hypothyroidism (cretinism). In A, the chronologic age is 16 years; carpal age, 16 years. In B, the chronologic age is 16 years; carpal age 7 years. In C, the chronologic age is 16 years; carpal age 2 years.

Gonadotropic Hormone.—The gonadotropic hormone, secreted by the basophilic cells, consists of the follicle-ripening fraction (prolan A) and the luteinizing fraction (prolan B). It also serves indirectly to inhibit the action of the growth hormone through its stimulating action upon the gonadal hormones. With the attainment of puberty and the increased activity of the gonadotropic and gonadal hormones, growth is inhibited and slowed down. The period of active

growth is thus ended and epiphyseal closure ensues. The tallness of the eunuch or early castrate is the result of the absence of the growth-inhibiting effect of the gonadal hormones and the persistence of active growth through the failure of epiphyseal closure.

Hypopituitarism.—General considerations: A deficiency in the secretion of the growth hormone causes marked deceleration in the growth of all tissues, hard and soft. The earlier the effect, the more severe the result. The "pituitary dwarf" is small, symmetrically proportioned, understatured and underdeveloped, resembling a well-proportioned child of a much lower chronologic age (pituitary infantilism). (Figs. 3-5.) This is in contrast with the types of understature produced by deficiencies of the growth factors in other endocrine glands (thyroid or gonads) wherein disproportion or dwarfing results. (Figs. 3-5.)

Craniofacial development: The effect of hypopituitarism upon the craniofacial skeleton is in harmony with the effect upon the entire body economy. The cranium and face develop very slowly and resemble those of a child of a much earlier chronologic age. (Fig. 4.) The face characteristically is relatively small when compared with the cranium. The result is a childlike appearance. The paranasal sinuses, particularly the frontal sinus, are underdeveloped. (Fig. 4.)



A B C

Fig. 5.—Composite tracings of cephalometric headplates taken of male patients and similar to those shown in Figure 3. A, normality; B, hypopituitarism, and C, untreated cretinism. The smaller size and symmetrical proportions (hypoplastic pattern of development) are evident in B and the disharmony of cranial, facial and dental development (dysplasia) in C. In A, the eruption is 16 years; dentin age, 16. In B, the eruption age and dentin age are 11 years. In C, the eruption age is 8 years; the dentin age, 12 years.

The genital system as well as the skeletal system remains relatively immature, but in harmony with the skeletal age. Pituitary infantilism is not usually manifest before 4 to 6 years of age. Therefore, the nervous system, which has virtually attained its development by the sixth year, is much less affected than the other tissues. In the hypopituitary case, the patient is alert and his intelligence quotient is in harmony with his chronologic age. Thus, mentally, he is well above his developmental age.

Hypopituitarism in the living can rarely be proved by objective means since no method of assay of the amount of pituitary secretion is yet available. In certain rare cases, calcified tumors of the hypophysis can be demonstrated roentgenographically (Bronstein). Diagnosis is usually made by elimination of other factors, familial or nutritional, osteochondrodystrophy, etc. Unproved, but suspected hypopituitarism is generally known as Levi-Lorraine dwarfism.

Growth of the jaws: The effects upon the growth and eruption of the teeth are similar to those upon the bony skeleton. The dentition as judged by the eruption of the teeth is that of a much younger child. Normally, the vertical height of the jaws and the length of the arch are increased by the eruption of the teeth. In hypopituitarism, the failure in eruption results in an insufficient increase in vertical height and arch length so that the teeth, the crowns of which are of normal size, may become crowded or submerged. (Fig. 4.)

Occasionally, there is a tendency to a distal relation of the mandible to the maxillae, which is an accentuation of the normally retruded mandible of the infant. This may be explained on the basis of the slowing down of the condylar growth of the mandible, which normally is the site of most rapid growth and where it persists after the body of the mandible is completed, causing it to become more prominent with age.

Eruption of teeth: Eruption is retarded and shedding is delayed in harmony with the retardation in general body growth and development. The hypopituitary patient shows a denture which is characteristic of and in keeping with his developmental status and skeletal age. Thus, in hypopituitarism, the patient of 18 chronologic years, but with a skeletal age of 8, shows the denture of a typical 8 to 10-year-old child.

Growth of enamel, dentin and cementum: The onset of pituitary dysfunction usually does not occur until from 4 to 6 years, after the crowns of the permanent teeth (except the third molars) are fully formed and calcified. The presence of so-called "small teeth" in pituitary dwarfism, occasionally referred to, is not supported by fact. The teeth are relatively less erupted and the clinical crown is therefore small. The size of the anatomic crown is, however, not affected. The juvenile characteristics are seen in incomplete, but growing roots with wide apical foramina.

Calcification: Overcalcification of the cranial bones has been reported by Mortimer and Goldzieher. Sclerosis of the dentin and bone has also been reported. (Schour, Brodie and King.)

Experimental hypophysectomy: Hypopituitarism in man is never so severe as complete experimental hypophysectomy in animals. Hypophysectomized animals (rat, dog and monkey) show a marked deceleration in the growth of all tissues, as seen in man. In hypophysectomized rats, the eruption is retarded within the week following the operation and is the first developmental process to be affected in the teeth. This retardation is progressive until eruption ceases. Replacement therapy, if administered early, with growth hormone is effective in lessening retardation of eruption. (Schour and Van Dyke.)

The enamel, dentin and cementum are laid down slowly. The crowns of the molars are normal in size since they are completed before the time of hypophysectomy, but juve-

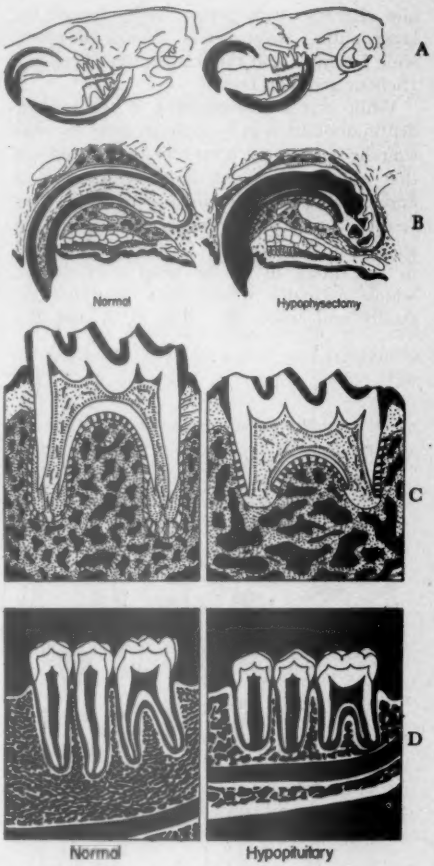


Fig. 6.—Effect of deficiency in secretion of growth hormone from anterior pituitary. A, drawings of lateral roentgenograms of skulls of albino rats. B, enlarged drawing of rat incisors in sagittal section. C, enlarged drawing of rat molars in mesiodistal section. The albino rats from which these sections and drawings were made were 300 days old at the time they were killed, but the ones on the right were hypophysectomized at 40 days. D, drawing from intra-oral roentgenograms from normal and hypopituitary males aged 16 years. The effect of hypopituitarism upon the growth of bone and the eruption of the teeth is to be noted.

nile characteristics persist, as evidenced by large pulps, incompletely developed roots, wide foramina and thin cementum. (Fig. 6.) (Schour and Van Dyke.)

While direct measurement of the rate of dentin apposition in hypophysectomy by vital staining has not yet been reported, it appears that eruption is much more retarded than apposition of the dentin and enamel. The result of this disproportion is seen in the striking folding of the formative zone and in the filling in of the pulp with dentin, which normally would have migrated incisally and worn off. (Fig. 6, A and B.)

sclerotic effects are seen in both the dentin and the bone, which show a deeper staining with hematoxylin. The periodontal membrane shows calcification of its fibers. (Schour and Van Dyke.)

Other effects of hypopituitarism: Pituitary hypofunction may express itself in other ways than infantilism, depending on the cells and therefore on the hormone affected. A deficiency of the gonadotropic hormone in the young results in a secondary hypogonadism, known as Fröhlich's syndrome. In this condition, the child is markedly obese and somewhat understatured and the genitalia

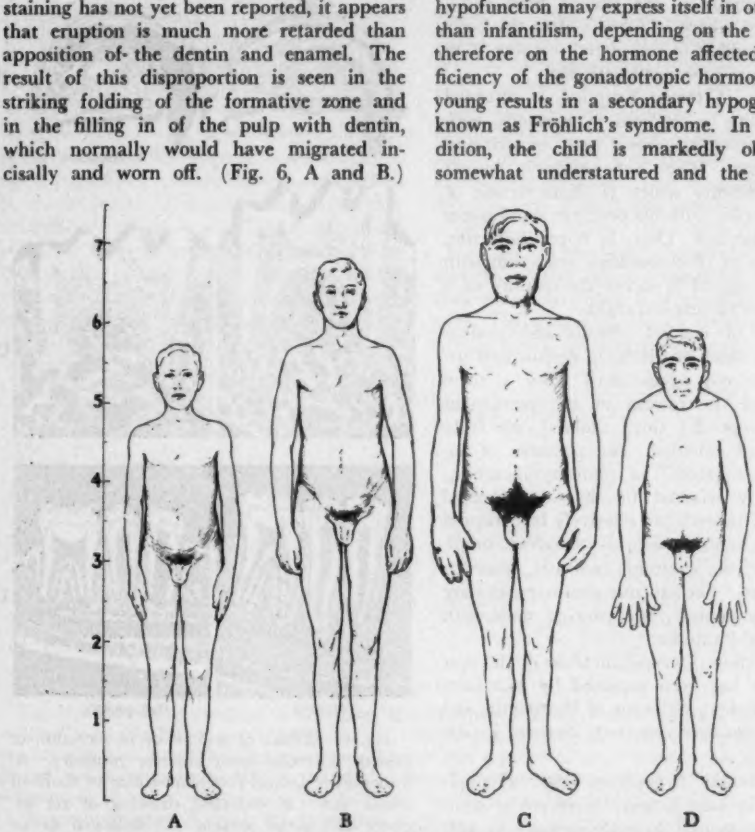


Fig. 7.—Composite drawings showing effect of hypersecretion of growth hormone at different ages. (Drawn from figures in Wolf's "Endocrinology" and Zondek's "Diseases of Endocrine Glands," and from photographs of patients.) In A, the chronologic age is 17 years; height, 5 feet 8 inches. In B, the chronologic age is 17 years; height, 6 feet 9 inches. In C, the chronologic age is 25 years; height, 7 feet 5 inches. In D, the height is 5 feet 10 inches.

The striking reduction of the blood supply characteristic of hypophysectomy may be the basis for the severe effect upon eruption. (Schour and Van Dyke.)

Calcification: Calcification is disturbed in the direction of overcalcification rather than undercalcification, although this is not marked. In experimental hypophysectomy,

are markedly underdeveloped. True Fröhlich's syndrome is relatively rare and is not to be confused with the prepuberal obesity of childhood, which resembles it superficially. In the latter, there is no understature or true hypogonadism and usually the condition resolves itself spontaneously at puberty. (Bronstein.)

Another rare condition associated with pituitary hypofunction is premature senility, or progeria. In the young, it is evidenced as a marked aging of the face and tissues and is often accompanied by skeletal and sexual infantilism.

A similar condition affecting the adult is known as Simmonds' disease. The individual becomes literally skin and bones and is markedly cachectic.

Pituitary therapy: It must be emphasized that treatment of understature by pituitary growth hormone is not yet possible. The growth hormone has not yet been extracted in sufficiently pure or concentrated form. Therapy with present preparations has been effective in animals, but has failed in man. Occasional reports of remarkable results have been shown to be due to spontaneous resolution.

The gonadotropic fraction has been prepared in relatively pure form and is effective in the treatment of undescended testes.

Fig. 8.—Contrast between growing and growing up (redrawn from Todd, 1937); white male skulls (W.R.U. 0.100,291 and 410). A, normal skull at 12 months of age. B, abnormal growth due to continuance of generalized type of growth without localization, which normally begins at about 6 years of age. The absolute dimensions are increased, but the proportions remain infantile (18 years of age). C, normal skull at 18 years.

Hyperpituitarism.—General considerations; giantism: Hyperpituitarism in the young growing individual has a quite different effect from that in the adult. The effect of a hypersecretion of the growth hormone of the pituitary gland before the sixth year of age, when all structures are rapidly increasing in size, results in the uniform overgrowth of all parts of the body. The patient exhibits the normal proportions of the child, but the absolute size of each structure is markedly and similarly increased. The result is unusual height, with the proportions of a child. (Fig. 7.)

Juvenile acromegaly: During the period between the sixth year and puberty, when growth is gradually becoming localized to certain areas, an excess of the growth hormone produces giantism, with proportions, however, no longer childlike. The reason for this is that certain structures have attained adult proportions before this time, and the effect of the overgrowth is evidenced in only those structures that continue to grow. The result is an abnormal height, with fair proportions, but huge hands and feet and a very long face and prognathic jaw. (Fig. 7.)

Adult acromegaly: During the adult stage, hypersecretion of the growth hormone results in acromegaly characterized by overgrowth of only those parts growth of which persists in the adult; i.e., the face, hands and feet. The body does not increase in height, but the joints become knobby and the fingers and toes are very wide and appear short and blunt. (Figs. 7, 9, 10, 11.) The spine and clavicles also become grossly overgrown.

Fig. 9.—Acromegaloid facies in male; appearance before and after onset of disease. (Timme.)

Craniofacial development: The effects on craniofacial development also differ with age and the duration of the dysfunction. Hyperpituitarism during the early period of generalized growth results in abnormal size of the craniofacial skeleton, which is of childlike proportions. (Fig. 8.) When after 6 years of age, growth of the cranium is almost complete, the relative overgrowth of the facial skeleton results in the acromegaloid

Fig. 10.—Findings in 43-year-old acromegalic, male: height, 6 feet 2 inches; weight, 250 pounds; duration of disease, fifteen years. A, lateral headplate. B, lateral view of dried skull. C, occipital view of dried skull. D, basicranial view of dried skull.

facies. (Fig. 7.) The face, which grows throughout life, is markedly overgrown in comparison with the cranium, and is abnormally large and coarse. The vertical height of the face is increased in the nasopharyngeal as well as in the masticatory region. The paranasal sinuses are markedly overdeveloped. (Fig. 10.)

It must be pointed out that, in a sense, acromegaly is an accentuation of the normal growth pattern, prolonged in time. Theoretically, one living to an age of 200 years would attain the acromegaloid facies. (Keith.)

Growth of jaws: The supra-eruption of the teeth produces a marked overgrowth of the alveolar process, which, in turn, causes an increase in circumference of the arch and consequent spacing of the teeth. (Fig. 10.)

Because of the normally persistent and rapid growth of the condylar head, the effect upon the mandible is greater than upon the rest of the facial skeleton. The cellular activity appears to be more markedly increased at the sites of endochondral than at those of intramembranous bone formation. As a result, the height of the ramus is markedly increased and the mandible attains an anterior or Class III relation to the maxilla.

Eruption: The dental changes in hyperpituitarism are opposite to those found in hypopituitarism. Eruption is accelerated. This is evidenced in the supra-eruption of the teeth, the abnormally great distance between the root apices and the jaw base and in the wide spacing of the teeth.

Growth of enamel, dentin and cementum: The size of the crowns of the teeth and the thickness of the enamel and dentin are not affected, because the life span of the formative cells has been fulfilled before the condition began. The size of the tooth is determined at the time of outlining of the dentino-enamel junction (during the first year of life for most of the permanent teeth.) Hyperpituitarism seldom, if ever, occurs at such an early age. However, hypercementosis does occur, since cementum normally grows throughout life and is therefore affected by the increase in rate of systemic growth.

Fig. 10 (cont.).—E, intra-oral roentgenograms (courtesy of J. M. Spence); showing overgrowth of facial skeleton, mandibular prognathism, supra-eruption of teeth and enlargement of sinuses. The calvarium is markedly increased in thickness, particularly on the endocranial (internal) aspect. (Case obtained through courtesy of Departments of Anatomy and Roentgenology of University of Chicago.)

Korkhaus pointed out the possible rôle of the enlarged tongue in mandibular prognathism and spacing of the teeth.

Handelsman and Gordon injected the alkaline extract of the pituitary gland in rats in conjunction with the madder-feeding technic and found that the rate of bone formation was increased. This increase, however, was restricted to those sites that were active at the time of the injection.

Experimental data on dental changes have not been reported for the obvious reason that a potent extract of the growth hormone is not yet available. A useful method of assaying the potency of a pituitary growth hormone would consist of measuring the increase in rate of eruption and rate of apposition of dentin and cementum resulting from its administration.

(To be continued.)

COUNCIL ON DENTAL EDUCATION

MIDYEAR REPORT

To the Board of Trustees:

THIS midyear report to the Board of Trustees covers the activities of the Council on Dental Education from July 1, 1942 to February 1, 1943. Within that time, the Council has held two regular meetings and has been chiefly concerned with the prosecution of its long contemplated plan of establishing a list of approved dental schools. Fully a year before Pearl Harbor, requirements for the approval of a dental school were formulated and widely distributed, the methods to be employed in the visitation of schools were announced and documentary information was sought from all the schools. The undertaking was therefore well underway when the present emergency arose.

A question naturally was raised about the wisdom of proceeding with visits of inspection to the schools under the existing troubled conditions. The Council gave careful consideration to the issue, found that the National Association of Dental Examiners and the great majority of the deans of dental schools favored adherence to the announced plans and accordingly began its visits to the schools in the first week of October 1942. Funds were provided for the inspections upon recommendation of the Board of Trustees and approval by the House of Delegates at the meeting of the American Dental Association at St. Louis in August 1942, and the appointment of guest inspectors and the payment of expenses and of *per diem* allowances for the special services of these inspectors and of accompanying members of the Council were subsequently approved by the Board of Trustees.

The procedure now under operation is to have each school visited by a committee of three persons consisting of a member of the Council, a guest inspector and the secretary of the Council. The committee spends three days in each school. The professional members of the committee appraise the entire program of teaching and research and the secretary inquires into all administrative and general educational procedures. Twenty-three of the thirty-nine dental schools in the United States have been visited and inspected and plans are complete for similar visits to the remaining sixteen schools before the first of July 1943. Seven members of the Council and three guest inspectors have participated in the visits thus far made. It is expected that each member of the Council will visit at least three schools.

The experience of the committees, now covering three-fifths of the schools, convinces the Council that it was wise to go forward with this important undertaking even in a time of war. Indeed, the peculiar problems in each school arising out of the present situation call for the closest possible relationship of the Council with all the schools and for its cooperation with them in a broad constructive way. Everywhere, the committees have been cordially received by the deans and faculties of the dental schools and by the presidents of the universities and other university officials with whom the dental schools are mainly associated. The conduct of the inquiry, coupled with the announced requirements for the approval of a dental school and the procedures to be employed in finally establishing a list of approved schools, is meeting with widespread approval among like accrediting agencies and in general university circles. The committees feel that they have been able to get a fair and just picture of the level of accomplishment in each school. It is true that several of the schools have suffered from the loss of faculty members who have withdrawn to enter the armed forces or to engage in other war work.

The Council is gratified, however, to be able to report to the Trustees that there has as yet been no material diminution of the established professional program and that, with very few exceptions, the schools are faithfully observing the predental requirements prescribed by the Council. The apparent ease with which the schools have all changed over to accelerated schedules is cause for congratulation to the entire profession. This change puts added burdens upon both students and faculties, but these burdens are being borne without complaint and with a high example of patriotic endeavor. The immediate problems ahead of the schools as the Army and Navy begin to exercise a measure of control will raise new and possibly troublesome questions. The Council wishes to assure the Trustees that it will do everything in its power to preserve the standards of predental and professional training already established and, at the same time, to cooperate fully with all agencies of the Government engaged in prosecution of the war.

Much will remain to be done by the Council after the visits of inspection to the schools have been completed. It will then be necessary to combine and collate the reports of the inspectors with the documentary data already compiled in the office of the Council. Through the employment of criteria covering all phases of organization, administration, teaching and research, the schools will be ranked from one to thirty-nine and a pattern map will be drawn for each school showing the tenth in which it falls in the rank of all the schools. Full information will be furnished each school concerning the Council's findings regarding it, but such information will be communicated to each school in confidence.

After all available information has been studied and after all pattern maps have been drawn, the Council will be faced with the problem of the number of schools which will merit approval and the number which may be required to make changes or adjustments before qualifying for approval. No hasty action will be taken. It may be necessary to withhold public announcement of an approved list to give certain schools reasonable time within which to qualify. The Council proposes to proceed deliberately, to avoid injury or injustice to any school. The Council conceives its responsibility as a constructive one. Its purpose is to strengthen and to improve dental education and to build for the future upon what it finds in the present. The Council believes that the Trustees and the entire dental profession may look forward to the establishment of a list of approved dental schools which will command general respect and confidence.

The Council has endeavored in recent months to crystallize the thinking of dental educators and of the profession generally with relation to provisions for meeting the dental needs of the armed forces and also of the civilian population. Educators throughout the country, recalling the untoward experience of educational institutions with the S.A.T.C. during the World War, are anxious that mere regimentation shall not now be permitted to interfere with such programs of education as it may be deemed desirable to continue during time of war. The maintenance of the prevailing standards of predental and professional training and of the present output of the schools is highly desirable, in the judgment of the Council. Under date of December 12, 1942, the War and Navy Departments issued a joint statement of their plans for the use of college facilities for the educational training of enlisted men for the various services at the college level. The sections of this joint statement bearing upon dental education were considered at length in a conference called by the Council in Chicago, December 20, 1942, participated in by the Council, the Executive Committee of the American Association of Dental Schools, the Subcommittee on Dentistry of the Procurement and Assignment Service and

the chairman of the War Service Committee of the American Dental Association. The conference recorded its common judgment as follows:

1. That contractual relations entered into by a dental school or by a university in behalf of a dental school for the training of dental students should provide in every instance for the training of candidates for both the Army and the Navy in order that there shall be no disruption of present enrollments and that the full resources of each school may be used.

2. That in view of the absence of definitely announced predental requirements in the Army statement and of specific requirements in the Navy statement differing from the requirements now in force, it is highly desirable (a) that uniform predental requirements as between the Army and the Navy be determined upon; (b) that the specific predental subject requirements announced by the Council on Dental Education and now being faithfully observed by the dental schools in the United States should be maintained, and (c) that the conference convey its recommendation to all the dental schools that no exaction of more than the two-year minimum requirement in liberal arts be made of any new student for the duration.

3. That the geographic distribution of dental schools and the sources from which dental students are recruited are such as to make it difficult to maintain the program of dental education by restricting the admission of students to schools in specified areas and that every effort should therefore be made to maintain an even and equitable distribution of dental students, again to the end that the full resources of all the schools may be used.

4. That the present dental curriculum covering four academic years, now being administered by all the dental schools under an accelerated plan so as to enable all students to complete the course within three calendar years, should be maintained in order that the marked progress of dental education in recent years may not be lost and in order that competently trained dentists may be steadily available to meet the needs and demands of the civilian population as well as of the Army and the Navy.

5. That such military training and discipline as may be necessary in the dental schools should be coordinated with and subordinated to the orderly and continuous processes of professional training.

6. That it is desirable that opportunity be given by both the Army and the Navy for the continuance of dental internships in approved hospitals for periods of one year.

The conference also endorsed a communication addressed by C. Willard Camalier, chairman of the War Service Committee, to the War Manpower Commission, in relation to the number of students to be earmarked in high school for dentistry, the number to be allowed to pursue predental courses in liberal arts colleges and the number to be admitted to dental schools to meet the needs of the Army and the Navy and the civilian population and to keep the schools employed upon the basis of the present enrollment of first-year students. The numbers proposed by Dr. Camalier, after consultation with the President of the American Dental Association and the secretary of the Council on Dental Education, paralleling by the same ratios the numbers in medicine as presented by the Board of Procurement and Assignment Service to the War Manpower Commission, were as follows: (a) to be earmarked in high school, 3,825; (b) to remain in liberal arts colleges for two years, 7,200; (c) to be admitted to dental schools annually, 2,700.

The Dental Students' Register, compiled each year as of October 15, has been issued for 1942. The register shows a first-year class of 2,702 and a total undergraduate enrollment of 8,847, the largest since 1927. Of this number, 2,400, or about 27 per cent, held a bachelor's or other degree before beginning the study of dentistry; 2,106, or about 23 per cent, had two or more years of liberal arts training, and 4,338, or nearly 50 per cent, had two or more years of liberal arts training. Only three students had less than two years of predental training and they were holdovers from the time of earlier requirements. It may not be possible to maintain this gratifying situation

fully during the exigencies of war, but the Council looks confidently for continued improvement in dental education once peace comes.

Respectfully submitted,

M. WEBSTER PRINCE,
Chairman,
WILLIAM N. HODGKIN,
Vice Chairman,
ROY O. ELAM,
LEROY M. S. MINER,
J. BEN ROBINSON,
JOHN T. O'ROURKE,
MINOR J. TERRY,
ROBERT P. THOMAS,
ARTHUR C. WHERRY,
HARLAN H. HORNER,
Secretary.

COMMITTEE ON ECONOMICS

INDUSTRIAL DENTISTS ORGANIZE

THE long-awaited meeting of men engaged in industrial dental practice has at last been held. The meeting, sponsored by the Committee on Economics of the American Dental Association and originally scheduled in conjunction with the Annual Meeting which was to have been held in Boston during 1942, was necessarily postponed. However, February 22, 1943, about sixty dentists from all sections of the United States came together to discuss the problems confronting the dental program in industry during the war emergency. Deliberation was not limited to the special problems created by the war, however. Attention was also given to a long-term program for this type of dental service.

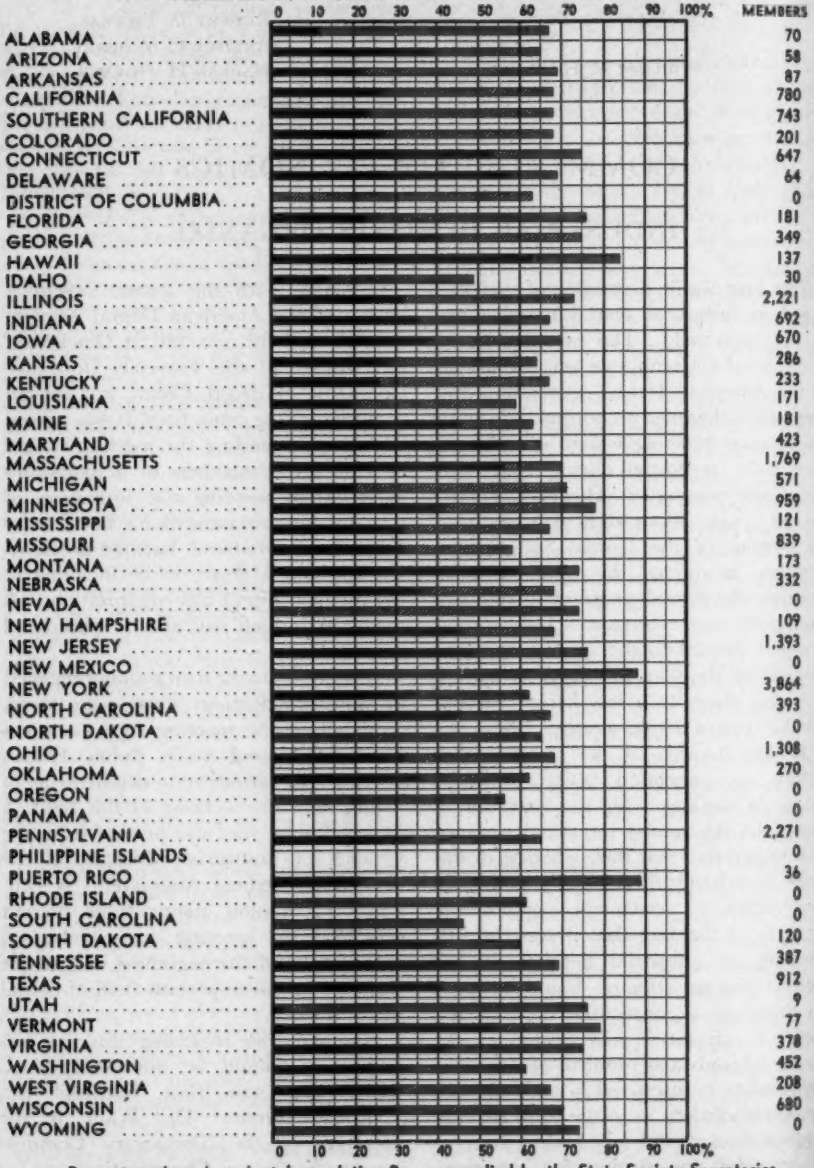
It was decided at the meeting that before any concerted action could be taken in dealing with the problem of dental health among industrial workers, it is imperative that men working in this field first band themselves together in some kind of permanent organization. In view of the fact that it was the first meeting of industrial dentists, it was agreed that no attempt should be made to draw up a constitution at that session. A committee was elected by the group to study the problem of organization and to be prepared to make specific recommendations as to the form that the organization should take and to draw up a proposed constitution for consideration at a second meeting to be held in conjunction with the annual executive session of the American Dental Association, to be held next fall at Cincinnati. Dr. Arnold, of the Travelers Insurance Company, Hartford, Conn., was elected chairman of the committee. It was agreed that those attending the meeting should be considered members of a temporary organization pending the formation of a permanent organization. Those who were unable to attend, but had previously expressed a desire to be included in the membership of any organization that might be formed will also be considered members.

In addition to the men actually engaged in industrial dentistry, there were in attendance at the meeting representatives from the United States Public Health Service and various state departments of health who are working in this field. A representative was also present from the Council on Industrial Medicine of the American Medical Association. A consensus of opinion among those present was that the meeting was timely and that it marked the beginning of a major advance in this important field of dental health service.

Any inquiries regarding this new organization should be addressed to R. M. Walls, 222 East Superior St., Chicago, Illinois. Dr. Walls is the secretary of the Temporary Committee to Form an Organization of Industrial Dentists.

Membership Page

PERCENTAGE OF DUES RECEIVED IN CENTRAL OFFICE AS OF FEBRUARY 28, 1943, AS COMPARED TO 1942 MEMBERSHIP



Percentage based on dental population figures supplied by the State Society Secretaries.

1943 percentage 1942 percentage

HISTORY COMMITTEE

PROGRAM FOR 1943

BELIEVING that it was important now, while World War II is at its height, to begin the collection of material bearing on the part that the members of the dental profession, both in and out of the armed forces, are playing in this struggle, the history committee outlined and is putting into action the following plan:

1. The country was arbitrarily divided into twelve districts.

2. Each member of the history committee was assigned various numbers of states.

3. Each committee member received a list of the states assigned to him, the names and addresses of the state secretaries and the names and addresses of the history committee chairman of the states having history committees.

4. Each committee member was advised to:

A. Contact the chairman of the state and local society history committees in his district.

B. Have them send to him quarterly reports on items of activity of their dental societies which have a bearing on the war effort.

C. Write the secretaries of the state and local societies in these states, asking their cooperation in sending this information, as it applies to the state society.

D. Write the editors of the dental publications in his district, asking them to publish, not only as much information as possible in the journals pertaining to activities of their group that concerns the war effort, but also "personals," news items about dentists from their districts who are in the armed forces.

E. Ask the editors to send him back copies of their journals for 1942, and to put him on their mailing list to receive their journals for the duration.

F. Clip from these journals all items pertaining to the foregoing.

G. Send these clippings plus the reports from the state and local secretaries and chairmen of history committees to the chairman of the History Committee of the American Dental Association.

5. A letter was mailed from the chairman's office to each of the state dental society presidents and secretaries, outlining our plan and asking their cooperation.

6. Letters were also sent to the presidents and secretaries of the states who do not have history committees, asking that such a committee be appointed immediately.

7. Letters are being sent to dental schools, fraternities and dental manufacturers, informing them of our plan and asking them to cooperate by sending us information about their war activities.

8. Brig. Gen. R. H. Mills, chief of the Dental Division of the Army, and Capt. Albert Knox, chief of the Dental Division of the Navy, have agreed to furnish the committee with information about their respective branches of service as this material becomes available.

It is not the intention of your chairman to write the History of Dentistry in World War II, but rather to assemble the material so that when the time comes to write the history, the facts will be available.

If the Board of Trustees considers the foregoing plan worthy of continuation, it will be necessary to increase the appropriation to this committee. Well over half of the $100 allotted to this committee has already been spent. We request an additional $150 to carry on these activities to October 1, 1943. The Board of Trustees will recall that we originally requested an appropriation of $250, which was reduced to $100.

Two members of the American Dental Association have indicated their desire to be the full time or part time dental historian as recommended by Dr. Oliver in his President's Report. These applications are being considered.

Respectfully submitted,

W. N. HODGKIN
FREDERICK E. SOWERBY
JOHN W. COOKE
E. C. MILLS
R. L. SPRAU
E. W. SWINEHART
L. PIERCE ANTHONY
ERNEST W. ELMEN
DON M. HAMM
W. F. LASBY
B. W. WEINBERGER
E. C. WETZEL
W. HARRY ARCHER, *Chairman*

AMERICAN DENTAL ASSOCIATION MEETING OF THE HOUSE OF DELEGATES

OCTOBER 11-13, 1943 AT CINCINNATI, OHIO

THE opening session of the House of Delegates will convene at 10 a.m., Monday, October 11. The second session will be held at 2 p.m., Monday, October 11; the third session at 2 p.m., Tuesday, October 12, and the fourth session at 2 p.m., Wednesday, October 13.

The four sessions of the House of Delegates will be held in the Hall of Mirrors of the Netherland-Plaza Hotel. The Credentials Committee will register Delegates and Alternates beginning 10 a.m., Sunday, October 10, at the Netherland-Plaza Hotel.

Reservations should be made direct with the hotel.

HARRY B. PINNEY,
Secretary

CLEVELAND HEALTH MUSEUM EXHIBITS

OF the many exhibits of the New York World's Fair now on display at the Museum of especial interest to the dental profession are: different jaw movements in chewing; actual skulls of a wolf, a mountain goat and a human being, so mounted as to show the three typical jaw movements of the grass-eating and meat-eating animals, as well as the combined movements; especially useful for education in child dental care, an exhibit demonstrating, by turning a handle, the right ways of teeth-brushing; the exhibit "True or False," dealing with common fallacies in dental health and the one on "Saliva" stressing good chewing. These last two exhibits were shown for the first time at the Chicago Dental Society meeting and are available for loan.

Cleveland Health Museum,
8811 Euclid Ave.,
Cleveland, Ohio.

CHICAGO'S DENTAL HEALTH WEEK

THE week of April 12-17 has been proclaimed Dental Health Week in Chicago by Mayor Edward J. Kelly. The event is sponsored by the Dental Hygiene Institute of Chicago and officially endorsed by the Chicago Dental Society.

The week will open with a luncheon on April 12 at the Hotel Sherman.

Newspaper, radio and other publicity activities will spotlight the importance of dental health to wartime efficiency.

DENTAL HYGIENE INSTITUTE
OF CHICAGO.

CURRENT LITERATURE

Journal of Dental Research

December 1942

*Dental Prosthetic Restorations Constructed for Naval Personnel. C. C. DeFord and C. A. Schlack (U. S. Naval Dental School)—493.

*The Effect of Strontium on the Incisor of the Rat. I. Injection of Small Doses of Strontium Chloride as a Means of Measuring the Rate of Incremental Dentin Apposition. J. P. Weinmann (Chicago College of Dental Surgery)—497.

*Effect of Saliva on Capillary Permeability. B. M. Levy and J. L. T. Appleton (University of Pennsylvania)—505.

Opsonin in the Saliva of Caries-Negative and Caries-Positive Patients. C. W. Hammond and J. P. Weinmann (Chicago College of Dental Surgery)—509.

The Effect of a Low Calcium and Vitamin D Free Diet on the Skeleton and Teeth of Adult Rats. A. P. Lund and W. D. Armstrong (University of Minnesota)—513.

*Histochemical Study of Phosphatase and Glycogen in Fetal Heads. N. H. Horowitz (University of Southern California and California Institute of Technology)—519.

Ameloblastoma: Review of 34 Cases. J. L. Bernier (Army Medical Museum)—529.

*Cultivation and Isolation of Mouth Spirochetes. O. W. Wichelhausen and R. H. Wichelhausen (Johns Hopkins University)—543.

*Relationship of the Gingival Crevice and the Alveolar Crest. H. M. Goldman (Harvard University)—561.

Supplement. I. Sustaining Subscribers to the Journal—565. II. International Association for Dental Research. Register of Members as of December 1, 1942. Compiled by E. H. Hatton—566. III. Books Received, 1942—578.

Index to Volume 21—579.

General Matter for Volume 21: Title Pages —i. Contents of Volume—iii.

Dental Prosthetic Restorations Constructed for Naval Personnel

DENTAL prosthetic appliances numbering 891 and constructed for 587 patients at the Naval Dental School in the period of 1938 to 1940 inclusive were classified according to (a) various combinations and (b) specific numbers of teeth replaced by partial dentures.

Of all dentures, 28.6 per cent were complete cases and 71.3 per cent partial; 9.5 per cent were complete mandibular and 19.1 per cent complete maxillary dentures; 33.4 per cent were partial maxillary and 37.9 per cent partial mandibular dentures.

Partial maxillary and partial mandibular denture combinations were most frequently constructed (26.6 per cent) and complete mandibular and partial maxillary denture combinations most infrequently constructed (0.85 per cent).

Partial maxillary appliances supplying five teeth (19.1 per cent) and partial mandibular appliances supplying four teeth (19.8 per cent) were most frequently constructed. Partial maxillary dentures supplying eleven teeth (0.7 per cent) and partial mandibular dentures supplying twelve teeth (0.3 per cent) were most infrequently constructed.

Effect of Saliva on Capillary Permeability

THE effect of saliva on capillary permeability was studied by the trypan blue capillary permeability test in rabbits. Centrifuged human mixed saliva was injected into the previously depilatorized skin of a rabbit, being followed immediately by an intravenous injection of 7 cc. of 1 per cent trypan blue. Within five minutes, a blue blotch appeared at the site of the saliva injection.

Samples of filtered saliva (Jena sintered glass G5/3) were dialized, heated to 100°C. for five minutes, heated to 80°C. for five minutes, extracted with ether and injected into various animals as above, being followed by intravenous 1 per cent trypan blue. Control injections of distilled water, diluted Ringer's solution, diluted horse serum and physiologic sodium chloride solution were made. Blue blotches appeared at the site of every saliva injection. None were seen at the site of control solutions.

Menkin's method of isolating leukotaxine from inflammatory exudates applied to saliva

yielded a "leukotaxine like" substance. Injection intradermally of this substance, suspended in saline, into rabbits elicited a reaction identical to that of saliva injection.

The foregoing observations indicate that intradermal injection of saliva results in a prompt increase in capillary permeability. The factor responsible is not a protein, salt or enzyme. There is a substance in saliva which, isolated in crystalline form, increases capillary permeability.

Effect of Strontium on the Incisor of the Rat. I. Injections of Small Doses of Strontium Chloride as a Means of Measuring the Rate of Incremental Dentin Apposition

EIGHTEEN rats, from 23 to 96 days old, were given subcutaneous single or multiple injections of strontium chloride solution in concentrations of from 70 to 680 mg. per kilogram of body weight. Single and multiple injections of strontium chloride did not retard the normal rate of increase in body weight. Subcutaneous injections of strontium chloride even in a concentration of 70 mg. per kilogram of body weight produced sharp incremental lines in the dentin, growing and calcifying at the time, but not in the enamel. These markings proved to be a feasible method to measure the rate of dentin apposition. Measurement of the rate of dentin apposition suggested a higher rate after injection of strontium chloride than after injection of alizarin red S. This difference might be explained by a growth-depressing factor in alizarin.

Histochemical Study of Phosphatase and Glycogen in Fetal Heads

FETAL rat heads were studied histochemically from the thirteenth to the twentieth day of gestation for phosphatase (method of Gomori) and for glycogen (iodin stain). Three classes of tissues are distinguished: (1) those that contain phosphatase, but no glycogen; (2) those that contain glycogen, but no phosphatase, and (3) those that contain both phosphatase and glycogen. All the calcifying tissues come under 3, the incisors possibly excepted. Non-calcifying structures come under 1 or 3, or else contain neither phosphatase nor glycogen. Three human fetuses of 22, 31, and 33 mm. length, respectively, showed distributions of the two substances in essential agreement with the foregoing findings. It is concluded that both phosphatase and glycogen are involved in calcification. The mechanism of their interaction is believed to entail phosphorolysis of glycogen, thus providing a substrate for phosphatase.

Cultivation and Isolation of Mouth Spirochetes

PURE cultures of spirochetes were isolated from fusospirochetal lesions of the mouth. Material taken directly from the patient and material from guinea-pig abscesses produced by injection with material from the patient were purified by different methods: (a) filtration through Chamber-Pasteur filters; (b) cultivation in deep agar shake tubes containing beef heart infusion-agar, ascitic fluid and cysteine hydrochloride, and (c) cultivation in the depth of blood-agar plates. All cultures, including those used in the filtration experiments, were incubated anaerobically. The colonies in blood-agar plates are characteristic, poorly defined colonies surrounded by zones of partial hemolysis. Nineteen strains of mouth spirochetes isolated by these methods may be divided into three groups on the basis of their structure, growth requirements and saccharolytic activity.

Relationship of the Gingival Crevice and the Alveolar Crest

THE alveolar crest may show apposition of bone even in the presence of gingival inflammation and ulceration of the crevicular epithelium. In other cases, under similar conditions, resorption of the alveolar bone may be present. Therefore, it is concluded that the condition of the gingiva and of the gingival crevice does not necessarily determine whether there will be resorption of the alveolar crest, and that resorption may be influenced by other facts. Thus, further evidence is also presented to substantiate the clinical differentiation of two types of periodontal disease, gingivitis and marginal periodontitis.

Dental Caries Control Program in Missouri

By HAMILTON G. ROBINSON and ALLEN O. GRUEBBEL

A METHOD of dental caries control, based

on the reduction of carbohydrate intake under controlled conditions, is being employed in Missouri. To evaluate the effectiveness of the program, dental caries attack rates are determined by use of the salivary lactobacillus count method developed at Michigan. Laboratories of the state board of health and at Washington University and Kansas City University make the bacterial tests without cost to the dentists of Missouri. The dietary program is not suggested for general use, but is recommended only for those persons with more than 5,000 lactobacilli per cubic centimeter of saliva. The fact that some patients consume much candy and other refined carbohydrate material without evidence of caries can be explained on the basis of an immunity based on local or systemic conditions. The controlled patient may stay caries free or with a reduced caries rate because of a change in dietary habits or a more or less permanent change in the oral flora. The program is not designed to eliminate caries, but is essentially a control program.—*J. Missouri D. A.* 32:23-26, January 1943.

Periodontitis, the Periodontal Pocket of Inflammatory Origin

By EDGAR D. COOLIDGE

PERODONTITIS, a localized chronic inflammation of the periodontal tissues, involves the superficial gingival tissue, spreads along the vascular tissue into the bone marrow and eventually involves the periodontal membrane. The common conception of a pyorrhea pocket developing immediately from the gingival crevice into the periodontal membrane is not supported by recent histologic studies.

Weinman's studies in the *Journal of Periodontology,* 1941, page 71, revealed the fact that the alveolar bone becomes resorbed because the inflammatory elements infiltrate from the superficial tissue into the bone marrow. As the alveolar bone is resorbed, the periodontal membrane coalesces with the bone marrow and becomes so changed that its attachment to the cementum degenerates and is lost.

The presence of pus in the deep gingival crevice is the result of the escape of white blood cells and exudate from the surrounding tissue, where the defense reaction against the micro-organisms of the pus pocket is active. As long as the pocket remains, micro-organisms invade the pocket. Leukocytes, plasma cells and lymphocytes are attracted to the tissue surrounding the infected pocket. Pus is formed in the deep crevice or pocket and inflammation spreads into the bone marrow along the course of the blood vessels, causing progressive destruction of the supporting bone and the alveolar bone.

The pocket must be eliminated and the cause of the inflammatory process which starts the vicious circles must be eradicated. Usually, on removal of the irritation which causes the chronic inflammation, and the elimination of the pocket which harbors infectious material, the progress of the disease is checked. Recurrence or renewed progress of the disease then occurs only where traumatic influences or nutritional disturbances cannot be controlled.—*Illinois D. J.,* 12:3-9, January 1943.

Infected Wounds Involving Bone Treated with Sulfapyridine and Sulfathiazole

By J. F. HEGGIE, A. W. KENDALL and R. M. HEGGIE

SULFATHIAZOLE is more efficacious than sulfapyridine in the treatment of wounds involving compound fractures infected with *Staphylococcus pyogenes.* It should be administered preoperatively and postoperatively, orally and at the site of infection to assure the best results. Local administration is indicated as early as is practicable, as well as at the time of surgical intervention. Strains of the organism recovered in a large number of cases revealed diminution in alpha hemolysin production, but no alteration in coagulase. No sulfonamide-resistant staphylococci were encountered.—*Brit. M. J.,* 2:658, December 5, 1942.

FRED A. DRUSE.

Presentation and Evaluation of the Various Treatments for the Periodontal Pocket

By DONALD E. KELLOGG

THE selection of a method of elimination of a periodontal pocket is a difficult problem for the man who has no knowledge of histopathology. It is, therefore, suggested that histopathology be thoroughly understood. The method of pocket elimination is

then a matter of choosing one that suits the conditions present.

Several methods of pocket elimination can be used. Each method is best suited to some particular condition. These methods fall into the following classes: (1) conservative; (2) electrocoagulation; (3) drug-surgical; (4) modified flap, and (5) complete surgical.

An evaluation of these technics indicates that so long as one has a knowledge of histopathology and makes a correct diagnosis, including the use of intra-oral roentgenograms, it matters not exactly how elimination is accomplished.—*Illinois D. J.* 12:10-13, January 1943.

Periodontosis

By DAVID BERMAN

IN cases of periodontosis, one or several teeth are affected. Usually, it is one of the anterior teeth, which shows a loosening and "pathologic wandering." The mouth is free from local irritation and is apparently well cared for. The condition begins with a loosening, followed by a drifting and detachment of the periodontal membrane fibers. Finally, a pathologic pocket forms.

The exact cause is unknown. Dietary deficiencies, vitamin deficiencies and endocrine dysfunction, as well as any disease that lowers the general resistance of the patient, will lower the resistance of the tissues of the oral cavity and a non-inflammatory breakdown may occur.

Treatment for periodontosis must be based on (1) improving the systemic condition and (2) local treatment of the periodontal membrane. In the treatment of this condition, it is of prime importance to study the case and to attempt to determine the specific etiologic factors.—*Illinois D. J.* 12: 13-15, January 1943.

Fractures of the Mandible, Maxilla, Zygoma and Other Facial Bones

By DON C. LYONS

CASES were studied to determine the factors in the course of repair of fracture wounds and the incidence of postoperative complications. One of the greatest hazards to uneventful healing proved to be the loss or fracture of teeth, the restoration of which was necessary to reduce the fracture and establish normal occlusion. A suitable preoperative delay is of value to allow for control of hematoma and possible infection. Operations to restore the bones of the face should be designed to conserve as much tissue as possible. Standardization of the method of reduction is advisable. Every effort should be made to treat the patient soon after injury. Present methods of reduction make it possible for the patient to return promptly to his every-day life, keep his mouth clean and obtain a normal diet; thus reducing materially the incidence of postoperative infection.—*Am. J. Orthodontics*, 29:67, February 1943.

FRED A. DRUSE.

Polymerization of Individual Direct Acrylic Restorations

By G. B. SALISBURY

POLYMERIZATION begins when the monomer is added to the polymer powder. The process continues regardless of increase in heat or addition of other agents. When a saturated mass is employed, the results are similar microscopically whether it is cured at mouth temperature, at room temperature or in a heated flask. Excess monomer breaks down not only the elastic membranes of the polymer spheres, but also the polymer itself, which it dissolves, leaving a homogeneous mass. The degree of elasticity depends on the presence of unpolymerized spheres. With inadequate curing, globular polymers and interglobular spaces are shown and there is a tendency to distortion. Properly cured acrylics and direct acrylic prostheses are durable under occlusal stress, resilient, inert, harmless to the oral tissues and easily cleaned.—*D. Digest*, 49:60, February 1943.

PETER P. DALE.

Dental Corps Increases Its Responsibilities

By H. R. MILLS

OWING to the lowering of dental requirements for Army selectees, the Dental Corps must now rehabilitate dental cripples in ever-increasing numbers. The company commanders are cooperating by holding dental patients until the necessary emergency work is completed. It is the responsibility of the Army dentist to teach the fundamentals of dental health to the Army personnel. Shift schedules have been inaugurated to obtain

the greatest possible use of the facilities at hand. Prosthetic units have been established in camps and the development of mobile field dental laboratories is progressing rapidly. Special and advance training of dental personnel, officers and enlisted men is given at the Army Dental School in Washington, at the Medical Field Service School at Carlisle and at station hospitals and camps. The Dental Corps, by organization vested in the Medical Corps, is administered by designated members of the Dental Corps acting as advisers to the surgeon. The objective of the Dental Corps is not only to give the minimum of attention to the soldier's dental requirements, but further to instil in the minds of Army personnel the true meaning and value of dentistry.—*Mil. Surgeon*, 92:168, February 1943.

FRED A. DRUSE.

Oral Surgeon, Prosthodontist and Orthopedist as a Team in Difficult Fractures of the Jaw

By A. H. GRUNEWALD

SULFONAMIDE therapy has altered the treatment of extensive injury to the jaws. Every possible effort should now be made to retain all bone fragments regardless of the degree of damage. Difficult cases require the combined knowledge and technical skill of the oral surgeon, prosthodontist and orthopedist. A case is reported of a young man whose mandible from the second bicuspid tooth to the ramus of the opposite side was extensively comminuted and compounded internally and externally. The mandibular teeth from the left second premolar to the right central incisor were lost, and the right mandibular teeth loosened. Sulfadiazine was administered and the patient was treated for shock and hemorrhage. A cast gold maxillary skeleton with lucite saddles to fit over the edentulous areas of the mandible and along the lingual aspect of the remaining lower teeth was constructed and placed in the mouth twelve days after the initiation of treatment. The teeth were then wired and an elastic bandage applied. A lucite form covering the cheeks and mandible and held in position similarly to a Barton bandage replaced the intra-oral splint on the twenty-sixth day. Further corrections were then made in the occlusion and the necessary teeth were extracted. A lower partial denture ultimately completed restoration of the jaw.—*U. S. Naval M. Bull.*, 41:157, January 1943.

FRED A. DRUSE.

Standard Procedure for Determining Abrasion by Dentifrices

By M. L. TAINTER and S. EPSTEIN

THE mean abrasion produced by use of a dentifrice on seventy-two cusps of eighteen teeth may be measured with a variability of about 15 per cent with the method and apparatus described. Metal plates holding three teeth each rest in cast metal cups filled with the material to be tested moistened with a 50 per cent solution of glycerin in water. A brush of Exton bristle, pressed against the teeth with a weight of 237 gm., is drawn over them in 1¼ inch strokes at the rate of 7,000 strokes per hour. Abrasion is measured with a Starret jewelled dial gage. It was found that about 50 per cent of the abrasion produced by calcium carbonate U.S.P. selected as a standard of comparison was due to the action of the brush. Brushes of the best natural bristle were more abrasive. The concentration of calcium carbonate had little effect on its abrasiveness, but the presence of small impurities in the form of 240 mesh silica, apparently owing to its hardness, greatly increased the abrasive action. Tests using a slurry containing 20 gm. of calcium carbonate in 40 c.c. of 50 per cent glycerin in water showed that dentin abraded twenty-five times, and cementum thirty-five times more rapidly than enamel from molar cusp tips.—*J. Am. Coll. Dentists*, 9:353, December 1942.

H. B. MCCAULEY.

Character of Age Changes in Enamel and Dentin and Their Relation to the Vital Dental Pulp

By C. F. BODECKER

THE enamel of teeth that have been in the mouth less than five years is permeable from within and contains channels composed of organic structures which may have a nutritional function. Enamel and dentin contain a fluid (dental lymph) assumed to be a vehicle for the distribution of nutritional elements. A mineral metabolism of

fully erupted teeth is confirmed by experiments employing radioactive phosphorus. Increase in the calcification of dentin in fully erupted teeth is attributed to the action of dental lymph under conditions imposed by dietary habit. The phenomenon of protective metamorphosis occurring some time after eruption is also attributed to the action of the dental lymph. Dyes having small molecules introduced into the pulps of the teeth of dogs and recently erupted human teeth are deposited in the enamel adjacent to the terminal branches of dentinal tubules in about one hour. Increased hardness observed in the enamel of mature teeth as compared with those recently erupted and the changes of hypercalcification and metamorphosis in dentin are considered as dependent on the vital pulp. The normal activity of this organ may be responsible for the occasional resistance of the teeth to caries.—*J. Am. Coll. Dentists*, 9:380, December 1942.

H. B. MCCAULEY.

Salivary Calculus: Its Cause and Control

By W. H. SAVAGE

SALIVARY calculus in solution is found in all mouths and is precipitated only under certain conditions. Calcium phosphate, its chief constituent, has two forms: insoluble basic phosphate containing a high proportion of lime, and soluble acid phosphate containing a smaller proportion of calcium. Addition of lime to acid phosphate converts it into the insoluble form, which is precipitated. In the mouth, precipitation of tartar occurs only in the presence of agglutinin or mucin, which serves to bind calcareous particles to exposed hard surfaces of teeth or prostheses. Salivary calculus can be controlled through the diet and systematic twice-daily brushing of the teeth.—*D. Items Int.*, 65:159, February 1943.

PETER P. DALE.

Classification of Epithelial Cancers Based upon Site or Origin

By E. A. MERRITT and RALPH M. CAULK

THE proposed classification covers only epithelial malignancy, with the sole exception of lymphosarcoma. The study was originally undertaken with a two-fold purpose; namely, to evaluate the results of treatment by roentgen rays and, at the same time, to reclassify the cases so that a more satisfactory cross-index could be instituted. The location of a tumor and a consideration of the surrounding tissues are important in treatment and prognosis. The classification presented is purely anatomic and is largely separated from previous surgical or pathologic and microscopic impressions. It makes cases readily accessible to follow-up and study. Lesions in and around the oral cavity are of particular interest to the dentist.

The numerical listing indicates the relative proportions in which the various lesions have presented themselves in the series of cases treated by the authors between 1933 and 1940.

Superficial epitheliomas (face, neck, scalp, extremities, trunk, penis, vulva, anus [those of the face include 103 cases of lip cancer]), 599.

Nasal cavity, 7.

Nasal accessory sinuses, 21.

The antra are frequently affected by malignant degenerations. Tumors originating here quite often grow to large size and invade either the orbit of the nasal fossa, or the hard palate and superior alveolus before they are recognized clinically.

Oral cavity

1. Alveolus, 25.
2. Buccal mucosa, 26.
3. Hard palate, 1.
4. Tongue, 62.
   a. Dorsum, 26.
   b. Base, 14.
   c. Infralingual portion, 22.

The infralingual portion of the tongue includes those lesions of the floor of the mouth. These and lesions at the base of the tongue are entirely different from dorsal lingual lesions because of the dense vasculoconnective tissue of the tumor bed.

Nasopharynx, 15.

Oropharynx (including 37 cases of the tonsil and 9 of the soft palate), 50.

Hypopharynx, 17.

Larynx, 25.

Trachea, 3.

Lung, 28.

Alimentary tract, 182.

Liver, biliary passages, and pancreas, 11.

Female generative organs, 475.

Male generative organs, 79.

Urinary tract, 116.

Endocrine glands, 9.

Breast, 574.

—*Am. J. Roentgenol. & Rad. Therapy*, 49:99, January 1943.

JOHN T. OBA.

Deep Infections of the Neck

By H. B. ORTON

DEEP cervical fascia covers the soft parts of the neck collectively and by its inflection forms separate sheaths of the muscles, vessels and glands. Knowledge of the attachments of the principal layers of the cervical fascia is essential to a complete understanding of the course which pus takes when it forms in the neck. If it is sealed under the superficial layer (which is attached to the clavicle), it may burrow beneath the clavicle into the axillary region, but if it is sealed beneath the deep layer(which is attached to the first rib), the situation then becomes more serious, since the pus formed may travel through the loose tissues by the side of the pharynx and make its way into the chest. There are four pathways by which infection usually extends in the neck: (1) superficially; (2) pretracheally; (3) buccopharyngeally; (4) prevertebrally. The majority of submaxillary infections follow the removal of teeth under local anesthesia. The hypodermic needle is an important factor in the cause through forcing infective material directly into adjacent areas or breaking down nature's protective barrier. These infections spread by fascial planes to the sublingual and submaxillary regions and eventually to the pharyngomaxillary spaces, then downward to the mediastinum, death ultimately resulting either from suffocation due to edema of the larynx or from mediastinitis. This is the type of infection that is so frequently seen in hospitals subsequently to dental extractions. The best method of drainage in these infections is the submaxillary approach. Ludwig's angina is an acute, virulent diffuse cellulitis of the mouth, secondary to dental caries, often extending to the structures around the pharynx and larynx and frequently to the cellular tissues of the neck. The patient is acutely ill and has pain in the floor of the mouth. Swallowing is painful and difficult. There is exquisite tenderness on palpation and a hard mass is felt in the floor of the mouth. There is no point of fluctuation, the entire process taking place in a relatively short time. For relief of the symptoms and to provide adequate drainage, an incision is made below the jaw from the posterior border of the mylohyoid to the chin, going through the skin and fascia and severing the mylohyoid, the digastric muscles transversely and the geniohyoid muscle, and continuing to the opposite side if both sides are involved. Chemotherapy should be utilized in all neck infections early in the course of the disease. General anesthesia is contraindicated in the presence of dyspnea.—*J. A. M. A.*, **120**:25, November 21, 1942.

Vincent's Infection

By R. L. CAUTLEY

VINCENT'S infection appears to be largely epidemic and transmissible by direct contact. Owing to metabolic disturbances occasioned by poor diet, chronic Vincent's infection may become endemic in some persons, causing them to act as carriers. Living under crowded conditions seems to provide the opportunity for contamination of the healthy, aided perhaps by temporary lowering of resistance to infection in the presence of common colds or faulty dietary conditions. The acute form appears often in the otherwise healthy mouths of the young. Most effective agents in treatment are the arsenical powders, including neo-arsphenamine. Applications of chromic acid (10 per cent), hydrogen peroxide and zinc oxide and eugenol paste are good superseding treatments. Thorough scaling and cleaning of the teeth are necessary after the acute stage has subsided. Foci of reinfection must be removed to avoid recurrence.—*Brit. D. J.*, 74:34, January 15, 1943.

FRED A. DRUSE.

Inverse Ratio Between Fluoride in Food and Drink and Dental Caries

By J. F. MCCLENDON, W. C. FOSTER and G. C. SUPPLEE

MILK from localities involved in dental caries studies reported by the U. S. Public Health Service was analyzed for fluoride. The incidence of dental caries in city school children from 12 to 14 years of age varied inversely with the fluoride content of the milk supply. The correlation coefficient of caries to fluorine was -0.37.—*Arch. Biochem.* 1:51, October 1942.

PETER P. DALE.

ANNOUNCEMENTS

ANNOUNCEMENTS must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

CALENDAR OF MEETINGS

CLEVELAND (OHIO) DENTAL SOCIETY SPRING CLINIC, May 10-12.

DISTRICT OF COLUMBIA DENTAL SOCIETY, second and fourth Tuesdays in each month, from October to June, at the United States Public Health Service Auditorium, Washington.

KANSAS STATE DENTAL ASSISTANTS ASSOCIATION, Kansas City, Mo., May 11-13.

NATIONAL BOARD OF DENTAL EXAMINERS, May 3-4.

NEW YORK SOCIETY FOR ORAL DIAGNOSIS, New York, April 14.

ONTARIO DENTAL ASSOCIATION, Toronto, Canada, May 17-19.

STATE SOCIETIES

April

Alabama, at Birmingham (13-14)
California, at San Francisco (12-14)
Kentucky, at Louisville (5-7)
Louisiana, at New Orleans (8-10)
Michigan, at Detroit (19-21)
Mississippi, at Jackson (12-13)
Oklahoma, at Oklahoma City (11-14)
Texas, at Fort Worth (19-22)
Virginia, at Roanoke (19-21)

May

Arizona, at Phoenix
Connecticut, at Hartford (7-8)
Georgia, at Atlanta (17-19)
Illinois, at Peoria (10-14)
Indiana, at Indianapolis (17-19)
Iowa, at Des Moines (3-5)
Kansas, at Kansas City, Mo. (11-13)
Maryland, at Baltimore (3-4)
Massachusetts, at Boston (17-20)
Missouri, at Kansas City (11-13)
Montana, at Helena (6-8)
Nebraska, at Omaha (10-12)
New Jersey, at Newark (4-5)
New York, at Syracuse (18-21)
North Carolina, at Raleigh (3-5)
North Dakota, at Fargo (10-11)
Pennsylvania, at Pittsburgh (4-6)
South Carolina, at Columbia
South Dakota, at Huron (9-11)
Vermont, at Burlington (19-20)
West Virginia, at Parkersburg (17-19)

June

Colorado, at Denver (17-19)
District of Columbia, at Washington (8)
Idaho, at Twin Falls
Nevada, at Reno
New Hampshire, at Manchester (9)
New Mexico, at Carlsbad
Oregon, at Portland (10-12)
Utah, at Salt Lake City (3-5)
Wyoming, at Casper

September

Southern California, at Los Angeles (13-15)

November

Ohio, at Cleveland (7-10)

January 1944

Rhode Island, at Providence

STATE BOARDS OF DENTAL EXAMINERS

California, at San Francisco, April 19. Kenneth I. Nesbitt, 515 Van Ness Ave., San Francisco, Secretary.

Delaware, at Wilmington, April 6-9 (dentists); June 15-17 (dental hygienists). Charles R. Jefferis, Medical Arts Bldg., Wilmington, Secretary.

Maine State Board of Dental Examiners, at Augusta, April 23-24. Carl W. Maxfield, 31 Central St., Bangor, Secretary.

New Jersey, June 28-July 2. J. Frank Burke, 150 E. State St., Trenton, Acting Secretary.

New Mexico, at Santa Fe, June 14-17. J. J. Clarke, Artesia, Secretary.

North Carolina, at Raleigh, April 5. Wilbert Jackson, Rich Building, Clinton, Secretary.

North Dakota at Fargo, July 12-15. R. A. Andrews, Carrington, Secretary.

Pennsylvania, at Pittsburgh and Philadelphia, May 27-28 (dental hygienists). Reuben

E. V. Miller, 61 N. Third St., Easton, Secretary.

Vermont, at Montpelier, June 28-30. Charles I. Taggart, 139 Bank St., Burlington, Secretary.

West Virginia, at Charleston, June 28. R. H. Davis, 510 Goff Bldg., Clarksburg, Secretary.

AMERICAN ASSOCIATION OF ORTHODONTISTS

THE annual meeting of the American Association of Orthodontists which was to have been held in Chicago, May 3-6, has been cancelled.

MAX E. ERNST, *Secretary,*
St. Paul, Minn.

AMERICAN BOARD OF ORTHODONTICS

THE American Board of Orthodontics announces the cancellation of its 1943 meeting previously scheduled to be held in conjunction with the American Association of Orthodontists meeting in May. Due notice will be given of the next meeting of the board.

B. G. DE VRIES, *Secretary,*
Medical Arts Bldg.,
Minneapolis, Minn.

AMERICAN SOCIETY FOR THE ADVANCEMENT OF GENERAL ANESTHESIA IN DENTISTRY

THE spring meeting of the American Society for the Advancement of General Anesthesia in Dentistry will be held March 22, with dinner at the Republican Club, 54 W. 40th St., New York, at 7 p. m. and the scientific session at 8:30, with the president, James R. Cameron, of Philadelphia, presiding. The scientific program will consist of a series of brief presentations of office experiences with anesthesia, by members: Elmer H. Brown, Trenton, N. J.; Lawrence Lee Mulcahy, Batavia, N. Y.; A. B. Rosoff, New Haven, Conn.; William J. McLaughlin, Bridgeport, Conn.; George H. Gendron, New Bedford, Mass., and James R. Cameron, Philadelphia, Pa. The members will discuss the presentations from the floor. Members of the profession are invited.

M. HILLEL FELDMAN, *Secretary,*
730 Fifth Avenue,
New York, N. Y.

CLEVELAND DENTAL SOCIETY SPRING CLINIC

THE annual spring clinic meeting of the Cleveland Dental Society will be held May 10-12 at the Statler Hotel.

ALBIUN F. SADD, *Chairman,*
Publicity Committee,
7904 Superior Ave.,
Cleveland.

KANSAS STATE DENTAL ASSISTANTS ASSOCIATION

THE Kansas State Dental Assistants Association will meet in the Hotel Continental, Kansas City, Mo., May 11-13.

CREOLA-CHARLES BAKER,
Program Chairman,
Pratt.

NATIONAL BOARD OF DENTAL EXAMINERS

THE National Board of Dental Examiners will hold its next session for the examination of candidates in Parts 1 and 2, May 3-4, in schools where there are five or more candidates. For further information and application blanks, address

GORDON L. TEALL, *Secretary,*
514 Delaware St.
Hiawatha, Kan.

NEW YORK SOCIETY FOR ORAL DIAGNOSIS

THE next meeting of the New York Society for Oral Diagnosis will be held April 14 at 8:30 p.m., at Squibb Hall, 745 Fifth Ave., New York.

H. JUSTIN ROSS, *Secretary,*
515 Madison Ave.,
New York.

ONTARIO DENTAL ASSOCIATION

THE Seventy-Sixth Annual Convention of the Ontario Dental Association will be held at the Royal York Hotel, Toronto, May 17-19. Dentists from the United States and from all parts of Canada will be welcome.

EDMUND A. GRANT, *Secretary,*
86 Bloor St., West,
Toronto.

PAN AMERICAN MEDICAL ASSOCIATION

THE Pan American Medical Association is planing a war congress to be held in New York in May or June. The president of the association, José Arce, of Buenos Aires, on a recent visit to the United States, received the sanction of the U. S. State Department for the congress; subject to conditions that

may arise. The Section on Dentistry is to play an important part and arrangements for the dental program are being made.

ALFRED WALKER, *President*,
501 Madison Ave.,
New York.

ALABAMA DENTAL ASSOCIATION

THE next annual meeting of the Alabama Dental Association will be held in Birmingham, April 13-14.

PRYOR A. WILLIAMS, *Secretary*,
1005 Protective Life Bldg.,
Birmingham.

ARIZONA STATE DENTAL SOCIETY

THE next annual meeting of the Arizona State Dental Society will be held in Phoenix, in May.

BLAIR A. GLENNIE, *Secretary*,
Box 1911,
Tucson

CALIFORNIA STATE DENTAL ASSOCIATION

THE next annual meeting of the California State Dental Association will be held in San Francisco, at the Fairmont Hotel, April 12-14.

LLOYD E. LINEHAN, *Secretary*,
450 Sutter St.,
San Francisco.

SOUTHERN CALIFORNIA STATE DENTAL ASSOCIATION

THE next annual meeting of the Southern California State Dental Association will be held in Los Angeles, at the Ambassador Hotel, September 13-15.

ROBERT L. BORLAND, *Secretary*,
602 Chapman Bldg.,
Los Angeles.

COLORADO STATE DENTAL ASSOCIATION

THE next annual meeting of the Colorado State Dental Association will be held in Denver, at the Cosmopolitan Hotel, June 17-19.

CHARLES K. PHILLIPS, *Secretary*,
529 Majestic Bldg.,
Denver.

CONNECTICUT STATE DENTAL ASSOCIATION

THE next annual meeting of the Connecticut State Dental Association will be held in Hartford, May 7-8.

EARLE S. ARNOLD, *Secretary*,
37 Linnard Road,
West Hartford.

DISTRICT OF COLUMBIA DENTAL SOCIETY

THE next annual meeting of the District of Columbia Dental Society will be held in Washington, June 8.

J. WALTER BERNHARD, *Secretary*,
1835 Eye St., N. W.,
Washington.

GEORGIA DENTAL ASSOCIATION

The next annual meeting of the Georgia Dental Association will be held in Atlanta at the Ansley Hotel, May 17-19.

R. H. MURPHY, *Secretary*,
605 Bankers Insurance Bldg.,
Macon.

ILLINOIS STATE DENTAL SOCIETY

THE next annual meeting of the Illinois State Dental Society will be held in Peoria, May 10-14.

L. H. JACOB, *Secretary*,
634 Jefferson Bldg.,
Peoria.

INDIANA STATE DENTAL ASSOCIATION

THE next annual meeting of the Indiana State Dental Association will be held in Indianapolis, at the Claypool Hotel, May 17-19.

E. E. EWBANK, *Secretary*,
Kingman.

IOWA STATE DENTAL SOCIETY

THE next annual meeting of the Iowa State Dental Society will be held in Des Moines, at the Hotel Fort Des Moines, May 3-5.

C. S. FOSTER, *Secretary*,
803 Dows Bldg.,
Cedar Rapids.

KANSAS STATE DENTAL ASSOCIATION

THE next annual meeting of the Kansas State Dental Association will be held in Kansas City, Mo., May 11-13.

FRED A. RICHMOND, *Secretary*,
Huron Bldg.,
Kansas City, Kan.

KENTUCKY STATE DENTAL ASSOCIATION

THE next annual meeting of the Kentucky State Dental Association will be held April 5-7 at the Brown Hotel, Louisville.

J. L. WALKER, *Secretary*,
640 Barbee Way South,
Louisville.

LOUISIANA STATE DENTAL SOCIETY

THE next annual meeting of the Louisiana State Dental Society will be held in New Orleans, at the Roosevelt Hotel, April 8-10.

JULIAN S. BERNHARD, *Secretary*,
419 Medical Arts Bldg.,
Shreveport.

MARYLAND STATE DENTAL ASSOCIATION

THE annual meeting of the Maryland State Dental Association will be held in Baltimore, May 3-4.

PAUL A. DEEMS, *Secretary*,
Medical Arts Bldg.,
Baltimore.

MASSACHUSETTS DENTAL SOCIETY

THE next meeting of the Massachusetts Dental Society will be held in Boston, at the Hotel Statler, May 17-20.

PHILIP E. ADAMS, *Secretary*,
106 Marlborough St.,
Boston.

MICHIGAN STATE DENTAL SOCIETY

THE next annual meeting of the Michigan State Dental Society will be held in Detroit, at the Hotel Statler, April 19-21.

WILLIAM R. DAVIS, *Secretary*,
Michigan Dept. of Health,
Lansing.

MISSISSIPPI DENTAL ASSOCIATION

THE next annual meeting of the Mississippi Dental Association will be held in Jackson, April 12-13.

O. L. COLEE, *Secretary*,
Magnolia.

MISSOURI STATE DENTAL ASSOCIATION

THE next annual meeting of the Missouri State Dental Association will be held in Kansas City, May 11-13, in conjunction with the Kansas State Dental Association meeting.

C. W. DIGGS, *Secretary*,
Columbia.

MONTANA STATE DENTAL ASSOCIATION

THE next annual meeting of the Montana State Dental Association will be held in Helena, May 6-8.

T. T. RIDER, *Secretary*,
Missoula.

NEBRASKA STATE DENTAL ASSOCIATION

THE next annual meeting of the Nebraska State Dental Association will be held in Omaha, at the Fontenella Hotel, May 10-12.

C. A. BUMSTEAD, *Secretary*,
Stuart Bldg.,
Lincoln.

NEVADA STATE DENTAL ASSOCIATION

THE next annual meeting of the Nevada State Dental Association will be held in Reno, in June.

LOUIS M. NELSON, *Secretary*,
Reno.

NEW HAMPSHIRE DENTAL SOCIETY

THE next annual meeting of the New Hampshire Dental Society will be held in Manchester, June 9.

FLOYD E. WILLIAMS, *Secretary*,
Manchester.

NEW JERSEY STATE DENTAL SOCIETY

THE next meeting of the New Jersey State Dental Society will be held in Newark, at the Newark Athletic Club, May 4-5.

F. K. HEAZELTON, *Secretary*,
223 East Hanover St.,
Trenton.

NEW MEXICO STATE DENTAL SOCIETY

THE next annual meeting of the New Mexico State Dental Society will be held in Carlsbad in June.

J. S. EILAR, *Secretary*,
Aubuquerque.

DENTAL SOCIETY OF THE STATE OF NEW YORK

THE next annual meeting of the Dental Society of the State of New York will be held in Syracuse, at the Hotel Syracuse, May 18-21.

CHARLES A. WILKIE, *Secretary*,
One Hanson Place,
Brooklyn.

NORTH CAROLINA DENTAL SOCIETY

THE next annual meeting of the North Carolina Dental Society will be held in Raleigh, at the Sir Walter Hotel, May 3-5.

E. M. MEDLIN, *Secretary*,
Aberdeen.

OHIO STATE DENTAL SOCIETY

THE next annual meeting of the Ohio State Dental Society will be held in Cleveland, November 7-10.

EDWARD C. MILLS, *Secretary*,
255 E. Broad St.,
Columbus.

NORTH DAKOTA STATE DENTAL ASSOCIATION

THE 1943 meeting of the North Dakota State Dental Association will be held in Fargo, May 10-11.

W. C. FOLLETT, *President*,
Devils Lake.

OKLAHOMA STATE DENTAL SOCIETY

THE next annual meeting of the Oklahoma State Dental Society will be held in Oklahoma City, at the Skirvin Hotel, April 11-14.

EUGENE W. WISE, *Secretary*,
Medical Arts Bldg.,
Tulsa.

OREGON STATE DENTAL ASSOCIATION

THE next annual meeting of the Oregon State Dental Association will be held in Portland, June 10-12.

F. W. HOLLISTER, *Secretary*,
Selling Bldg.,
Portland.

PENNSYLVANIA STATE DENTAL SOCIETY

THE next annual meeting of the Pennsylvania State Dental Society will be held in Pittsburgh, at the William Penn Hotel, May 4-6.

EDWARD R. ASTON, *Secretary*,
421 Market St.,
Kingston.

RHODE ISLAND STATE DENTAL SOCIETY

THE next meeting of the Rhode Island State Dental Society will be held in Providence in January 1944.

CHARLES F. MCKIVERGAN,
Secretary Pro Tem.,
102 Waterman St.,
Providence.

SOUTH CAROLINA STATE DENTAL ASSOCIATION

THE next annual meeting of the South Carolina State Dental Association will be held in Columbia in May.

P. B. HAIR, *Secretary*,
Spartanburg.

SOUTH DAKOTA STATE DENTAL SOCIETY

THE next annual meeting of the South Dakota State Dental Society will be held in Huron, May 9-11.

ERNEST W. ELMEN, *Secretary*,
Sioux Falls.

TENNESSEE STATE DENTAL ASSOCIATION

THE Tennessee State Dental Association has cancelled its meetings for the duration of the war.

E. JEFF JUSTIS, *Secretary*,
1504 Exchange Bldg.
Memphis.

TEXAS STATE DENTAL SOCIETY

THE next annual meeting of the Texas State Dental Society will be held in Fort Worth, April 19-22.

WILLARD OGLE, *Secretary*,
Medical Arts Bldg.,
Dallas.

UTAH STATE DENTAL ASSOCIATION

THE next annual meeting of the Utah State Dental Association will be held in Salt Lake City, June 3-5.

C. G. GREEN, *Secretary*,
1001 Boston Bldg.,
Salt Lake City.

VERMONT STATE DENTAL SOCIETY

THE next annual meeting of the Vermont State Dental Society will be held in Burlington, May 19-20.

J. GILLAM IRONS, *Secretary*,
Bennington.

VIRGINIA STATE DENTAL ASSOCIATION

THE next annual meeting of the Virginia State Dental Association will be held at the Hotel Roanoke, Roanoke, April 19-21.

J. E. JOHN, *Secretary*,
Medical Arts Bldg.,
Roanoke.

WEST VIRGINIA STATE DENTAL SOCIETY

THE next annual meeting of the West Virginia State Dental Society will be held in Parkersburg, May 17-19.

M. H. NICHOLSON, *Secretary*,
Bluefield.

WYOMING STATE DENTAL ASSOCIATION

THE next annual meeting of the Wyoming State Dental Association will be held in Casper in June.

J. D. MCNIFF, *Secretary*,
Laramie.

BOARD OF DENTAL EXAMINERS OF CALIFORNIA

THE next examinations to be conducted by the Board of Dental Examiners of California for a license to practice dentistry and for a license to practice dental hygiene in California will be held in San Francisco commencing April 19. All credentials must be in the office of the Secretary, Room 203, 515 Van Ness Avenue, San Francisco, at least twenty days prior to the date of the examinations. Address all communications to Kenneth I. Nesbitt, Secretary, Room 203, 515 Van Ness Ave., San Francisco.

DELAWARE STATE BOARD OF DENTAL EXAMINERS

THE next examinations conducted by the Delaware State Board of Dental Examiners will be held April 6-9, for applicants for dental licenses, and June 15-17 for applicants for licenses as dental hygienists. All examinations will be held in Wilmington.

CHARLES R. JEFFERIS, *Secretary*,
Medical Arts Bldg.,
Wilmington.

MAINE STATE BOARD OF DENTAL EXAMINERS

THE next meeting of the Maine State Board of Dental Examiners will be held April 23-24 at the State House, Augusta. Applications with necessary fee must be in the hands of the secretary at least ten days prior to the date of the examination. Address all communications to

CARL W. MAXFIELD, *Secretary*,
31 Central St.,
Bangor.

NEW JERSEY STATE BOARD OF REGISTRATION AND EXAMINATION IN DENTISTRY

THE State Board of Registration and Examination in Dentistry of New Jersey will hold its next regular examinations commencing June 28 and continuing for five days. On application to the secretary, a copy of the requirements and rules, instruction sheet and preliminary application will be forwarded. Candidates were required to file the preliminary application blank, with the examination fee of $25, on or before March 15. Future schedules will be announced.

J. FRANK BURKE, *Acting Secretary*,
150 E. State St.,
Trenton.

NEW MEXICO BOARD OF DENTAL EXAMINERS

THE New Mexico Board of Dental Examiners will hold its next meeting June 14-17 in Santa Fe. For further information, address

J. J. CLARKE, *Secretary*,
Artesia.

NORTH CAROLINA STATE BOARD OF DENTAL EXAMINERS

THE next meeting of the North Carolina State Board of Dental Examiners for the examination of applicants for licensure will be held at the state capitol, Raleigh, beginning April 5. Applications must be filed with the secretary thirty days before the examination. For application blanks and further information, address

WILBERT JACKSON, *Secretary*,
Rich Building,
Clinton.

NORTH DAKOTA STATE BOARD OF DENTAL EXAMINERS

THE North Dakota State Board of Dental Examiners will hold its next examination in the Gardner Hotel, Fargo, July 12-15. For further information and applications, address

R. A. ANDREWS, *Secretary*,
Carrington.

DENTAL COUNCIL AND EXAMINING BOARD OF THE COMMONWEALTH OF PENNSYLVANIA

THE Dental Council and Examining Board of the Commonwealth of Pennsylvania will give an examination for license to practice dental hygiene in Philadelphia and

Pittsburgh, May 27-28. For further information and application blanks, address the Department of Public Instruction, Bureau of Professional Licensing, Dental Division, Harrisburg.

REUBEN E. MILLER, *Secretary,*
61 N. Third St.,
Easton.

VERMONT STATE BOARD OF DENTAL EXAMINERS

THE Vermont State Board of Dental Examiners will meet for the purpose of examining candidates in dentistry and dental hygiene, June 28-30, at the State House, Montpelier.

CHARLES I. TAGGART, *Secretary,*
139 Bank St.,
Burlington.

WEST VIRGINIA STATE BOARD OF DENTAL EXAMINERS

THE next meeting of the West Virginia State Board of Dental Examiners will be held in Charleston, commencing June 28. Applicants for license to practice dentistry or dental hygiene will be examined. Applications must be in the hands of the secretary ten days prior to the meeting. For application blanks and information, apply to

R. H. DAVIS, *Secretary,*
510-515 Goff Bldg.,
Clarksburg.

EXAMINATION FOR APPOINTMENT IN THE DENTAL CORPS OF THE NAVY

THE next examination for appointment as assistant dental surgeon, U. S. Navy (lieutenant [junior grade], Dental Corps, U. S. Navy) will be held at the Naval Training Station, Norfolk, Va., the Naval Training Station, Great Lakes, Ill.; the Naval Training Station, San Diego, Calif., and the Naval Dental School, National Naval Medical Center, Bethesda, Md., May 3. Application for this examination should be made to the chief of the Bureau of Medicine and Surgery, Navy Department, Washington, D. C. Applicants for appointment as assistant dental surgeon must be citizens of the United States, more than 21, but less than 32 years of age at the time of acceptance of appointment, and graduates of a class A dental school. A circular of information listing physical and other requirements for appointment, subjects in which applicants are examined, and other data pertaining to salary, allowances, etc., can be obtained from the Bureau of Medicine and Surgery, Navy Department, Washington, D. C.

DENTAL INTERNSHIPS

THERE will be two openings for dental internships available at the Gallinger Municipal Hospital, Washington, D. C., for the year beginning April 1. This is a 2,000 bed general hospital and the dental work is confined to minor and major oral and dental surgery for the inpatients of the hospital. For application forms, address Arthur Merril, Chief of Dental Division, Gallinger Municipal Hospital, Washington, D. C., giving a brief résumé of your scholastic record.

VOLUNTEERSHIPS AND EXTERNSHIPS, BRONX HOSPITAL

THERE are several volunteerships and externships available for recent graduates at the dental clinic, Bronx Hospital, in the following departments: oral surgery and exodontia, operative dentistry, orthodontia, surgical periodontia and root canal therapy. Applicants address David Wurzel, director of the Dental Department, Bronx Hospital, 169th St. & Fulton Ave., Bronx, New York.

RESIDENCIES AND INTERNSHIPS

THERE will be available July 1 at the Sea View Hospital, New York, N. Y., two dental residencies and two dental internships for a one year period. The Sea View Hospital, probably the largest tuberculosis hospital in the world, offers exceptional opportunities in most phases of dentistry. The dental residencies include a stipend of $1,200 annually plus maintenance; the internships, a stipend of $15 monthly plus maintenance. Application forms can be obtained from the medical superintendent, Sea View Hospital, Staten Island, New York.

RALPH HOWARD BRODSKY, *Director,*
Division of Oral Surgery.

CARNEGIE FELLOWSHIPS FOR RESEARCH AND GRADUATE WORK IN THE DENTAL SCIENCES

AIDED by the Carnegie Corporation of the New York and the Eastman Dental Clinic, the School of Medicine and Dentistry of the University of Rochester offers scholarships paying $1,200-$1,800 per annum to well-trained dental graduates who are interested

in research or who desire special training in the basic medical sciences as an aid to dental teaching or practice. A few fellowships also offer part-time training in oral surgery. On appointment, the applicant is given the title of Fellow in Dentistry and, according to his interest, works as a graduate student in one of the departments of the medical schools. Here, excellent laboratory facilities, adequate direction and close contact with various investigations related to medicine and dentistry help his research and study. Fellows are encouraged to attend medical classes, seminars and staff meetings and, when opportunity presents itself, to participate in class instruction and scientific meetings. Contact with the problems of clinical dentistry may be maintained through the Oral Surgery Clinic of the Strong Memorial Hospital and the Rochester Dental Dispensary. With the approval of the Graduate Council of the university, Fellows may prepare themselves for the degree of M.S. or Ph.D. Applications should be made to

GEORGE H. WHIPPLE, *Dean,*
Rochester, N. Y.

NEW YORK UNIVERSITY COLLEGE OF DENTISTRY POSTGRADUATE COURSE

NEW York University College of Dentistry announces a postgraduate course in inhalation anesthesia, with special emphasis on nitrous oxide-oxygen anesthesia, conducted by E. A. Rovenstine, professor of anesthesia, N. Y. U. College of Medicine and Bellevue Hospital, and A. S. Mecca, assistant professor of oral surgery, N. Y. U. College of Dentistry and Bellevue Hospital. The course will be given on Friday mornings beginning April 30 and ending June 4. Classes will begin at 9 a.m. and continue to 12 noon. Direct all communications to the office of the dean, N. Y. U. College of Dentistry, 209 E. 23rd St., New York, N. Y. Tuition is $60, half of which should accompany a letter of endorsement from the applicant's dental society, the balance to be paid on the day of entrance to the course.

OHIO STATE UNIVERSITY POSTGRADUATE COURSE IN DENTISTRY

THE College of Dentistry of Ohio State University, at Columbus, offers postgraduate courses in dentistry that are especially designed for the general practitioner who may wish to amplify his training in any of the following fields: oral surgery, prosthodontia, x-ray, crown and bridge, periodontia, operative dentistry and root canal therapy. The length and dates of the courses are as follows:

X-ray	June 7 to 11
Oral surgery	June 14 to 18
Prosthodontia	June 14 to 19
Crown and bridge	June 14 to 19
Operative dentistry	June 14 to 18
Root canal therapy	June 14 to 18
Periodontia	One day per week for ten weeks beginning June 23

The fees for these courses will be $50 a week, with the registration limited to ten men in each course, with the exception of prosthodontia, which will be $100 for the week's course, with registration limited to five.

It is the aim of these courses to teach new technics as well as to review the fundamentals. Further information and application blanks can be secured from the office of the dean, College of Dentistry, Ohio State University, Columbus.

THE MOUNT SINAI HOSPITAL NEW YORK CITY TWELFTH LECTURE COURSE IN DENTAL MEDICINE SEASON OF 1942-1943

April 20; Presentation of cases by the dental staff.

All lectures will start promptly at 8:30 p.m. and will be held in the lecture room on the third floor of the Administration Building. There will be a presentation of clinical cases before each lecture. All physicians and dentists are invited.

HARRY A. GOLDBERG,
Attending Dentist.

COLUMBIA UNIVERSITY SCHOOL OF DENTAL AND ORAL SURGERY REFRESHER COURSES

COLUMBIA University School of Dental and Oral Surgery offers a short course in periodontia for qualified graduates in dentistry September 18, 1942, to January 15, 1943.

A ten-day intensive course will include lectures, discussions, demonstrations and clinical practice. An extended course, one

half day per week for two sessions, will include lectures, discussions and supervised technical treatment. Both courses will be conducted by Frank E. Beube, Isador Hirshfeld, Harold J. Leonard (executive officer) and Arthur H. Merritt.

The courses given at the School of Dental and Oral Surgery, Columbia University, are designed to be "refresher" courses; i.e., to bring practitioners abreast of modern undergraduate teaching in theory and practice in the subject. Admission to the course is limited to qualified graduates in dentistry who are members in good standing of the American Dental Association or recognized sectional organizations. In the case of foreign applicants, membership in the applicant's national dental organization is required.

Information can be obtained from the registrar, School of Dental and Oral Surgery, 630 West 168th Street, New York, N. Y.

UNITED STATES PATENTS APPLICABLE OR PERTAINING TO DENTISTRY ISSUED DURING JANUARY AND FEBRUARY 1943

January 5

2,307,493, NATHAN J. DAVIDSON. Toothbrush.

2,307,677, ROY E. HAWKINSON. Dental apparatus.

January 12

2,308,078, LENNARD A. HENDRICKSON. Dispensing device.

2,308,195, CHARLES LEON MORRIS. Tooth facing and backing therefor.

2,308,450, EDWARD J. KRESSE. Dental amalgam mixer.

2,308,457, JACOB A. SAFFIR. Means for mounting artificial teeth.

January 19

2,308,553, GEORGE STEELE AND ADOLPH E. SCHNEIDER. Artificial tooth.

2,308,812, BERNARD JANKELSON. Dental unit.

January 26

2,309,084, MAURICE GEORGES WINTREBERT. Articulating means for artificial dentures.

2,309,136, ROBERT NEIMAN. Process for preparing an alloy for cast dentures.

2,309,270, NATHAN OPOTOW. Dental apparatus.

2,309,388, FRANCIS J. GIBBONS, ALEXANDER GIBBONS AND MARGARET ROM. Valve for water-cooled dental trays.

D-134, 905, MAX JEANNERET. Design for a dental parallel cavity former.

February 2

2,310,022, JAY A. HEIDBRINK. Oxygen delivering apparatus of the demand type.

2,310,132, LEIF UNDERDAHL. Material for construction of artificial dentures and process of producing the same.

2,310,155, ISAAC SLOMOVICI. Means for interchangeably mounting artificial teeth.

February 9

2,310,360, ABRAHAM FISCHER. Method of and means for registering bite rims or blocks.

2,310,409, MARTIN M. ELLMAN. Dental burr and hand-piece assembly.

2,310,448, HENRY H. LEIB. Dental apparatus.

2,310,571, JOHN W. BRADY. Toothbrush pack.

2,310,626, JACOB GOLD. Motor driven toothbrush.

2,310,732, CHARLES DIETZ. Alloy and dental article.

2,310,912, EDWARD I. MINTZ. Thermo model guide and filler.

February 16

2,311,141, HARRY A. TRUE. Dental separator.

2,311,158, JAMES V. CONWAY and WILLIAM P. CROCKETT. Method and means for making dentures.

February 23

2,311,760, JOHN D. KELLS. Fountain toothbrush.

2,311,836, LLOYD JONES. Means for making artificial dentures and apparatus therefor.

2,311,992, EDUARDO VILLASENOR OLASAGA and JOSÉ SANTIAGO TREJO SOLIS. System of dental prosthesis.